

# BROWN & SHARPE SMALL TOOLS



**WM. H. TAYLOR & COMPANY, INC.**  
**ALLENTOWN, PA.**

**WE CARRY A COMPLETE STOCK OF  
BROWN & SHARPE  
TOOLS AND CUTTERS**

**CATALOG NO. 29**  
**BROWN & SHARPE MFG. CO.**  
**PROVIDENCE, R.I., U.S.A.**





## New Tools and Cutters

**Y**OUR attention is called to the new tools and cutters which have been added to our line since the previous edition of our Small Tool Catalog was issued.

### TOOLS

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<b>Micrometer Calipers Nos. 2 RS to 53 RS.....</b>	<b>11-36</b>
Micrometers with ratchet stops up to and including No. 53 are now listed separately with the letters RS following the tool number.	
<b>Micrometer Calipers Nos. 17 and 17RS, with Wooden Handles.....</b>	<b>23</b>
These micrometers are now listed with wooden handle instead of the wooden handle being listed as an extra.	
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<b>Rex Micrometer Caliper Sets Nos. 133, 135, 137, 138, 139 and 140.....</b>	<b>46, 48-50</b>
These sets are made up of Rex Micrometers and are furnished with clamp rings.	
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Protect the micrometer and are handy to slip into the pocket.	
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Snaps on to the micrometer and equips it for measuring the walls of tubing and other rounding surfaces.	

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Helps to get accurate measurements in deep holes where the hand will not enter.	
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For accurately laying out and checking angles.	
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A handy square for diemakers, with a blade that can be set to an angle of 8 degrees either side of zero, with graduations indicating the angle of the setting.	
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# BROWN & SHARPE SMALL TOOLS

## CATALOG No. 29



Reg. U. S. Pat. Off.  
and Foreign Countries

### *Important*

**W**HEN ordering tools from this catalog always give the full name and tool number as listed, and mention "Catalog No. 29."

This will lessen the chances of mistake and will often save time and correspondence.

*Mention Catalog No. 29*

## BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U.S.A.

Established 1833

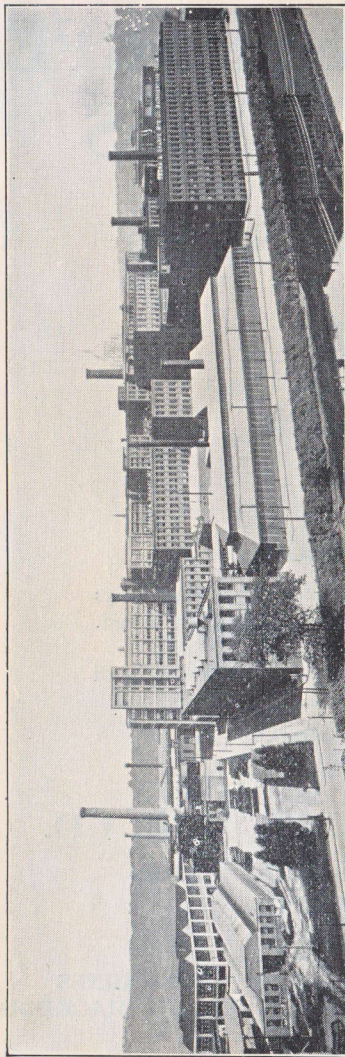
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Also Manufacturers of

MILLING MACHINES  
SCREW MACHINES

GRINDING MACHINES  
GEAR CUTTING MACHINES

1924

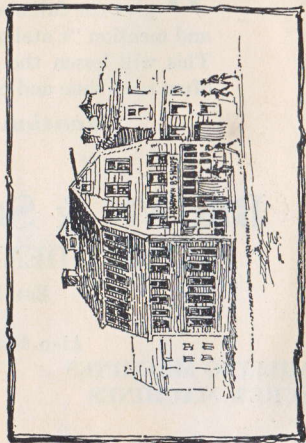


Main Office and Works of the Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.

## LEADING AWARDS RECEIVED

For the Excellence and High Quality of  
Brown & Sharpe Products

London, 1862; Paris, 1867 and 1878; Vienna, 1873; Philadelphia, 1876; Chicago, 1893; Tennessee Centennial Exposition, 1897; Buffalo, 1901; Paris, Grand Prix, 1889 and 1900; Brussels, Grand Prix, 1897; St. Louis, Grand Prize, 1904; Liège, Grand Prix, 1905; Milan, Grand Prix, 1906; Brussels, Grand Prix, 1910; Turin, Grand Prix, 1911; Tokio, 1915.





## OF GENERAL INTEREST

**T**HE business now conducted by the Brown & Sharpe Mfg. Co. was founded in 1833 by David Brown and his son Joseph R. Brown. David Brown retired in 1841 and the business was continued by Joseph R. Brown until 1853, when Lucian Sharpe became his partner, and the firm of J. R. Brown & Sharpe was formed. The Brown & Sharpe Mfg. Co. was incorporated in 1868.

The manufacture of Steel Rules and other tools of precision was begun by Joseph R. Brown in 1850. In 1852 a similar line of work was begun by Samuel Darling and, in 1866, the partnership of Darling, Brown & Sharpe was formed, the business being carried on under that name until the partnership was dissolved by the purchase of Mr. Darling's interest.

The buildings are modern and especially arranged to meet the requirements of the business. The machine shops are fireproof. The business, therefore, is free from danger of serious interruption, and, on work entrusted to us, customers are given security against loss by fire.

The ten main manufacturing buildings have a floor space of about 900,000 square feet, the foundry about 245,000 square feet, and the forging, hardening, central power plant, and miscellaneous buildings about 252,000 square feet. In 1853 the floor space occupied was 1,800 square feet. The present buildings have 1,397,000 square feet of floor space, or over 32 acres.

All Brown & Sharpe products are made with the intention that they shall be the best in their respective classes. Careful attention is constantly given to insure workmanship of the best quality. Should any defect become apparent in the workmanship of any of our tools, we request that we be notified promptly.

We are always ready and pleased to show our works to those who are interested in machine shop practice.

## IMPORTANT

*Please address all business communications to the Company.*

**ORDERING:** Always give the *tool number* and *size* of each article ordered and mention Catalog No. 29. All verbal orders and instructions should be confirmed in writing.

**SHIPPING INSTRUCTIONS:** State distinctly in giving shipping instructions, whether goods are to be sent by freight, express, or mail. When instructed to ship by mail we assume it is desired to ship by parcel post, insured. If no shipping instructions are given we will ship the way we consider best, taking into account the factors of cheapness, time of delivery, and safety, and in such cases we cannot be held responsible for transportation charges, delays, or loss in transit.

**CLAIMS:** Although goods are considered sold and our responsibility ceases when delivery is made to the post office or transportation company, in the event of goods being lost in transit we will do our best in the interest of the customer to have the lost goods found or else to have the post office or transportation company make proper restitution for the loss.

**RETURNING GOODS:** If for any reason goods are returned, the transportation charges must be paid and we particularly request in such cases that the name and address of the sender be plainly marked on the package. Always send a letter of explanation at the same time.

**SPECIAL ORDERS:** In ordering special tools, be sure to give full information, sketches, dimensions, etc. While special tools are often required we wish to impress on customers the advantage of ordering, if possible, goods that are carried in stock instead of goods that vary only slightly from stock articles and have to be made to order.

### TO DEALERS

**PRICES AND DISCOUNTS:** Prices in this catalog are list prices and subject to change without notice. Only legitimate hardware and supply stores are allowed dealers' discounts, which will be given on application. Cash must accompany orders from dealers without adequate commercial ratings before goods will be shipped, unless satisfactory references are given. Payment for goods may be made by express or postal money order, by cashier's check or by currency sent by registered mail. We do not pay transportation on goods shipped to dealers, nor do we pay duty on goods that are shipped into Canada.

**DISPLAY CASES AND DEALERS' HELPS:** We issue a special pamphlet on display cases and dealers' helps including window displays, circulars, electrotypes, etc., that we will furnish dealers on request.

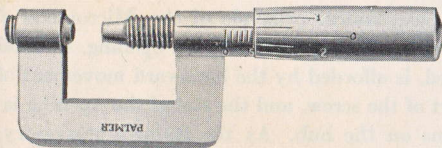
### TO MECHANICS AND MANUFACTURERS

**PURCHASING TOOLS:** We urge that mechanics and manufacturers buy our tools from hardware and supply dealers, the better class of which carry a stock. In the event that a dealer is not at hand we shall be glad to advise the nearest source of supply, or, if desired, the tools may be bought direct.

**PRICES AND DISCOUNTS:** Prices in this catalog are list prices and subject to change without notice. Only legitimate hardware and supply stores are allowed dealers' discounts. Cash must accompany orders from parties without adequate commercial ratings before goods will be shipped, unless satisfactory references are given. Payment for goods may be made by express or postal money order, by check on New York, or by currency sent by registered mail. In cases where machinists' tools cannot be obtained from dealers, we prepay transportation charges to any place in the United States and Canada. However, on goods shipped into Canada we do not pay the duty.



# The Micrometer Caliper



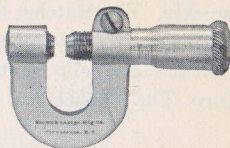
## Its History

IT is always interesting to trace the development of an idea from the time it first assumes definite form to the time it becomes of practical value. We must go back 76 years, and cross the ocean, to find the prototype of the micrometer of today in a French tool, known as the "Système Palmer," patented in France in 1848. Messrs. J. R. Brown and Lucian Sharpe, during their visit to the Paris Exposition in 1867, saw this and were impressed with its possibilities.

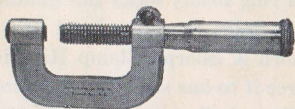
Incidentally, early in the same year, a concern in this country manufacturing brass had a shipment returned to them because it was "out of gauge." Investigation showed that of three U. S. Standard gauges then in use no two of them agreed as to the gauge of the brass in question.

The brass manufacturer, conceiving the idea of a measuring tool, sent a sketch to J. R. Brown & Sharpe for experimental work. This tool had no commercial value, as it was next to impossible to read with any accuracy. It was evident, however, that there was a demand for a tool adapted for measuring sheet metal and upon their return from Paris in 1867, Messrs. Brown & Sharpe introduced the "Pocket Sheet Metal Gauge," adopting the Palmer system of divisions, adding, however, means of compensating for wear of both the screw and measuring surfaces.

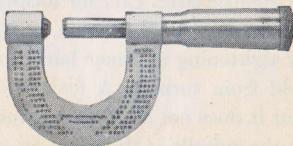
From this beginning, through acquired patents and ideas worked out in its own shops, the Brown & Sharpe Mfg. Co. produces a line of about 400 different Micrometer Calipers which meets the demand of all ordinary shop requirements.



Pocket Sheet Metal  
Gauge of 1867



Micrometer Caliper  
of 1877



Improved Micrometer  
Caliper of 1885

## The Principle of the Micrometer Caliper

**T**HE chief mechanical principle of the Micrometer Caliper is a screw free to move in a fixed nut. An opening, to receive the work being measured, is afforded by the backward movement of the spindle, which is a part of the screw, and the size of the opening is indicated by the graduations on the hub. As the frame is stationary, the spindle, which is attached to the sleeve, approaches or recedes from the anvil, when the sleeve is revolved. The graduations on the hub are in a line parallel to the axis of the screw and conform to the pitch of the screw. The beveled edge of the sleeve carries graduations which enable readings in thousandths of an inch and hundredths of a millimeter to be taken.

## Ratchet Stop

**T**HE Ratchet Stop, which can be furnished with any of our Micrometer Calipers, furnishes the same degree of pressure for each measurement, and eliminates any difference in the personal "touch." It is found convenient where a number of measurements have to be taken quickly. The Ratchet Stop, being small in diameter, facilitates quick opening of the micrometer, the pawl positively engaging the ratchet so that it cannot slip by, thus making the ratchet stop positive in its return. The ratchet and pawl are hardened.

## Clamp Ring

**T**HE Clamp Ring is a device, originally patented by the Brown & Sharpe Mfg. Co., for locking the spindle in position and preserving the setting. A slight turn on the knurled ring firmly locks the spindle by tightening an inner band circling the spindle, the inner band being held from turning. A feature of the Brown & Sharpe Clamp Ring is that it does not cramp the spindle and force it to one side. The pressure on the spindle is the same on all sides. The spindle is never forced out of line.

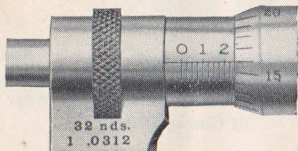




## How to Read Micrometers

### Graduated to Thousandths of an Inch

**T**HE customary pitch of the screw is 1-40" (40 threads to the inch). Thus, the distance traversed by the screw or spindle during one complete revolution is 1-40", or .025". As the graduations on the hub conform to the pitch of the screw (40 to the inch),



each division equals .025" and every four divisions represent 0, .100", .200", etc. (10ths of an inch); each tenth of an inch is numbered 0, 1, 2, etc. The beveled edge of the sleeve is graduated into 25 parts and figured every fifth division 0, 5, 10, 15 and 20. When 25 of these graduations have passed the horizontal line on the hub, the spindle, having made one revolution, has moved .025". Thus, when the spindle moves only far enough to cause one graduation to pass the horizontal line on the hub, it will have moved 1-25 of .025", or .001". The distance between the graduations on the sleeve is great enough to permit half and quarter thousandths of an inch to be readily estimated.

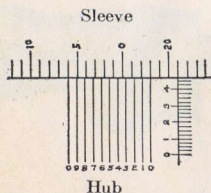
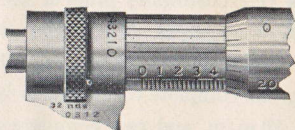
To read—First note the last figure visible on the scale on the hub, representing the tenths of an inch. Multiply the number of divisions visible beyond this figure by 25 and add the number of the division on the scale on the sleeve that coincides with the line of graduations on the hub. Then the tenths shown, added to this sum expressed in thousandths, is the reading.

Example:—In the cut, shown above, .200" (2-10") are shown by the figures on the scale on the hub and one graduation beyond a tenth graduation is also visible while on the bevel on the sleeve the graduations show 16 divisions from the zero to the line coincident with the horizontal line on hub. Then the reading = .200" + .025" + .016" = .241".



## How to Read Micrometers

### Graduated to Ten-Thousandths of an Inch



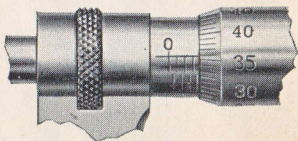
TO obtain readings in ten-thousandths of an inch a Vernier is employed on the hub of the Micrometer Caliper. The Vernier used, consists of ten divisions, which equal, in overall space, nine divisions on the sleeve. Thus, one division on the Vernier =  $\frac{1}{10} \times \frac{9}{1000''} = \frac{9}{10,000''}$ . Since each graduation on the sleeve =  $\frac{1}{1000''}$  or  $\frac{10}{10,000''}$ , the difference in space between a division on the sleeve and a division on the hub =  $\frac{10}{10,000''} - \frac{9}{10,000''} = \frac{1}{10,000''}$ . Since the two zero lines on the Vernier coincide with lines on the sleeve when the reading is exact with respect to the number of thousandths, the difference between the lines on sleeve and lines on Vernier at numbers 1, 2, 3, etc., equals .0001'', .0002'', .0003'', etc. Thus, when the 1st, 2nd or 3rd, etc., lines coincide, the sleeve has moved past the exact zero setting 1, 2 or 3, etc., 10,000ths of an inch to bring these lines together.

To read—First obtain the reading for the thousandths in the manner described in the preceding section and then add the ten-thousandths, the number of which is indicated by the line on the Vernier which coincides with a line on the sleeve.

Example:—As shown in upper part of line cut, there are no ten-thousandths to be added, for the two zeros on the Vernier coincide with lines on the sleeve; the reading = .4690''. In the lower cut the 7th graduation on the Vernier coincides with a line on the sleeve, indicating that 7 ten-thousandths should be added to the thousandths reading; the reading = .4690'' + .0007'' = .4697''.

## How to Read

### Micrometers Graduated for Metric Measure



**T**HE customary pitch of the screw is  $\frac{1}{2}$  m/m. Thus, the distance traversed by the screw or spindle during one complete revolution is  $\frac{1}{2}$  m/m, or .50 m/m, and two complete revolutions are required to move the spindle

a distance of 1.00 m/m. The graduations on the hub conform to the pitch of the screw. The upper set of graduations, representing m/m, is numbered every fifth graduation; the lower set of graduations subdivides each m/m division into 2 equal parts. The beveled edge of the sleeve is graduated into 50 parts and figured every fifth division 0, 5, 10, 15, 20, 25, 30, etc. When fifty of these graduations have passed the horizontal line on the hub, the spindle, having made one revolution, has moved .50 m/m. Thus, when the spindle moves only far enough to cause one graduation to pass the horizontal line on the hub, it will have moved  $\frac{1}{50}$  of .50 m/m, or .01 m/m. The distance between the graduations on the sleeve is great enough to permit half and quarter hundredths of a m/m to be readily estimated.

To read—First note the last figure visible on the scale on the hub representing a whole m/m. Note whether or not a half m/m division is visible beyond this graduation. Then determine the hundredths m/m by the line on the sleeve coinciding with the horizontal line on the hub. The m/m shown (plus .50 m/m if a half m/m graduation shows), plus the number of hundredths of a m/m, is the reading.

Example:—In cut above, 3 m/m graduations are shown; also a  $\frac{1}{2}$  m/m graduation is visible; on the bevel on the sleeve the graduations show 36 divisions from the zero to the line coincident with the line of graduations on the hub. Then the reading = 3.00 m/m + .50 m/m + .36 m/m = 3.86 m/m.



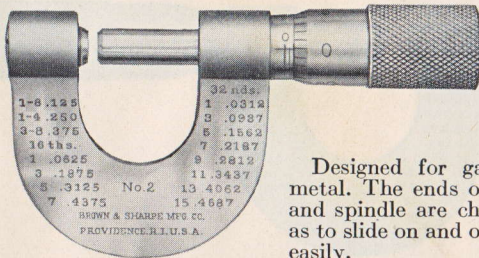
## Micrometer Caliper No. 2

**ENGLISH MEASURE**  
Range, 0 to 1-2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 13 mm  
by hundredths of a millimetre

**Price, \$7.00 Leather Case, \$1.20**



Designed for gauging hot metal. The ends of the anvil and spindle are chamfered so as to slide on and off the work easily.

Table of decimal equivalents omitted on Metric Micrometer.

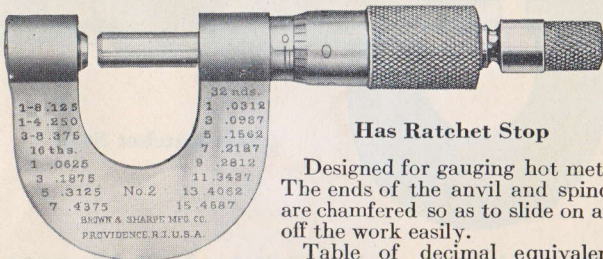
## Micrometer Caliper No. 2RS

**ENGLISH MEASURE**  
Range, 0 to 1-2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 13 mm  
by hundredths of a millimetre

**Price, \$7.50 Leather Case, \$1.20**



**Has Ratchet Stop**

Designed for gauging hot metal. The ends of the anvil and spindle are chamfered so as to slide on and off the work easily.

Table of decimal equivalents omitted on Metric Micrometer.

Each of the above packed one in a box.

## Micrometer Caliper No. 4

**ENGLISH MEASURE**  
Range, 0 to 1-2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 13 m/m  
by hundredths of a millimetre

**Price, \$7.00 Leather Case, \$1.20**

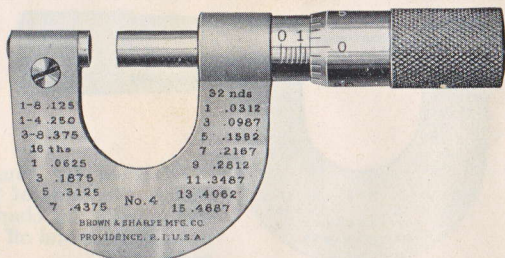


Table of decimal equivalents omitted on Metric Micrometer.

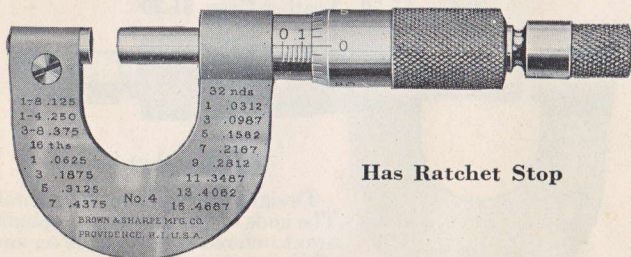
## Micrometer Caliper No. 4 RS

**ENGLISH MEASURE**  
Range, 0 to 1-2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 13 m/m  
by hundredths of a millimetre

**Price, \$7.50 Leather Case, \$1.20**



**Has Ratchet Stop**

Table of decimal equivalents omitted on Metric Micrometer.

Each of the above packed one in a box.



## Micrometer Caliper No. 5

**ENGLISH MEASURE**

Range, 0 to 1-2"

by thousandths of an inch

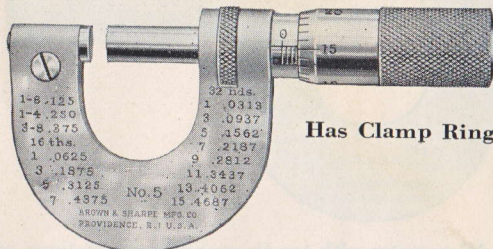
or

**METRIC MEASURE**

Range, 0 to 13 m/m

by hundredths of a millimetre

Price, \$8.00 Leather Case, \$1.20



Has Clamp Ring

Table of decimal equivalents omitted on Metric Micrometer.

## Micrometer Caliper No. 5 RS

**ENGLISH MEASURE**

Range, 0 to 1-2"

by thousandths of an inch

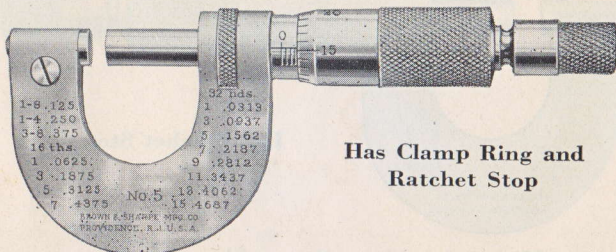
or

**METRIC MEASURE**

Range, 0 to 13 m/m

by hundredths of a millimetre

Price, \$8.50 Leather Case, \$1.20



Has Clamp Ring and  
Ratchet Stop

Table of decimal equivalents omitted on Metric Micrometer.

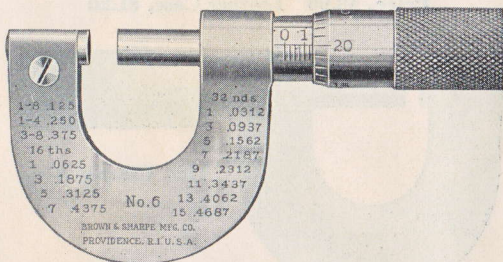
Each of the above packed one in a box.

## Micrometer Caliper No. 6

Range, 0 to 1-2"

by ten-thousandths as well as thousandths of an inch

Price, \$8.75 Leather Case, \$1.20



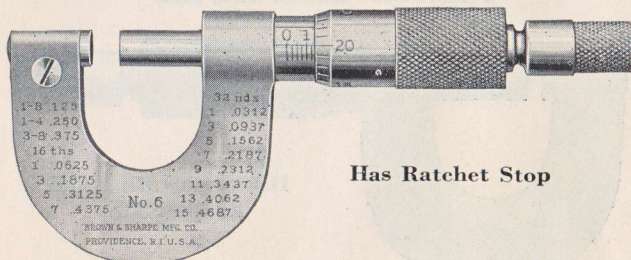
For reading Micrometer with ten-thousandths graduations, see page 9.

## Micrometer Caliper No. 6 RS

Range, 0 to 1-2"

by ten-thousandths as well as thousandths of an inch

Price, \$9.25 Leather Case, \$1.20



**Has Ratchet Stop**

For reading Micrometer with ten-thousandths graduations, see page 9.

Each of the above packed one in a box.

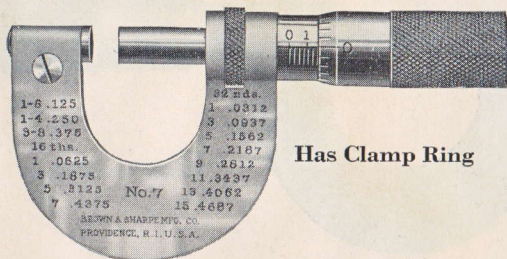


## Micrometer Caliper No. 7

Range, 0 to 1-2"

by ten-thousandths as well as thousandths of an inch

Price, \$9.75 Leather Case, \$1.20



Has Clamp Ring

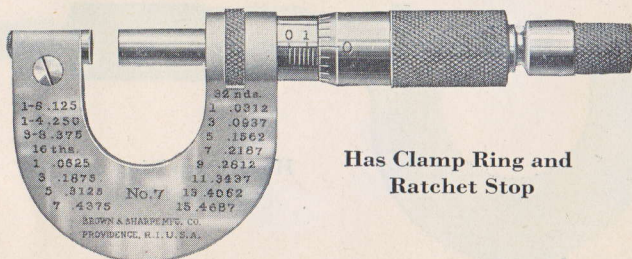
For reading Micrometer with ten-thousandths graduations, see page 9.

## Micrometer Caliper No. 7 RS

Range, 0 to 1-2"

by ten-thousandths as well as thousandths of an inch

Price, \$10.25 Leather Case, \$1.20



Has Clamp Ring and  
Ratchet Stop

For reading Micrometer with ten-thousandths graduations, see page 9.

Each of the above packed one in a box.

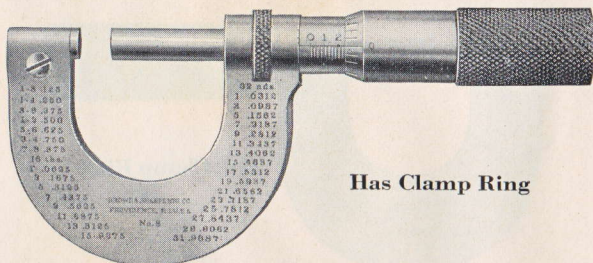
## Micrometer Caliper No. 8

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

Price, \$9.50 Leather Case, \$1.25



Has Clamp Ring

Table of decimal equivalents omitted on Metric Micrometer.

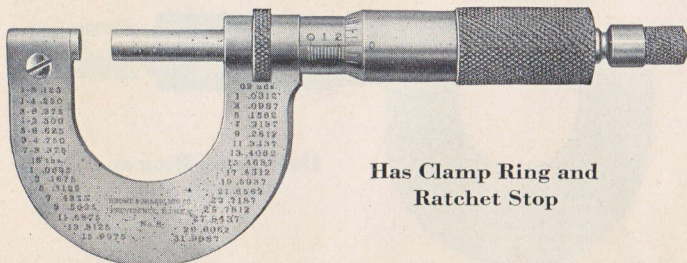
## Micrometer Caliper No. 8 RS

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

Price, \$10.00 Leather Case, \$1.25



Has Clamp Ring and  
Ratchet Stop

Table of decimal equivalents omitted on Metric Micrometer.  
Each of the above packed one in a box.

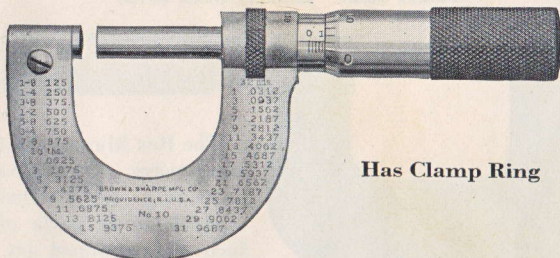


## Micrometer Caliper No. 10

Range, 0 to 1"

by ten-thousandths as well as thousandths of an inch

Price, \$11.25 Leather Case, \$1.25



Has Clamp Ring

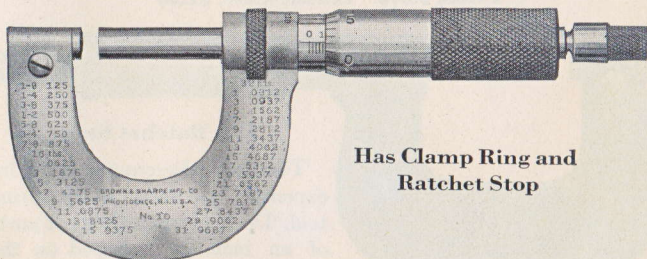
For reading Micrometer with ten-thousandths graduations, see page 9.

## Micrometer Caliper No. 10 RS

Range, 0 to 1"

by ten-thousandths as well as thousandths of an inch

Price, \$11.75 Leather Case, \$1.25



Has Clamp Ring and  
Ratchet Stop

For reading Micrometer with ten-thousandths graduations, see page 9.

Each of the above packed one in a box.

## Rex Micrometer Caliper No. 11

**ENGLISH MEASURE**

Range, 0 to 1"

by thousandths of an inch

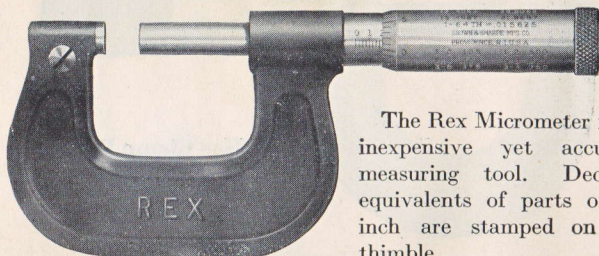
or

**METRIC MEASURE**

Range, 0 to 25 mm

by hundredths of a millimetre

Price, \$6.25 Leather Case, \$1.25



The Rex Micrometer is an inexpensive yet accurate measuring tool. Decimal equivalents of parts of an inch are stamped on the thimble.

Table of decimal equivalents omitted on Metric Micrometer.

## Rex Micrometer Caliper No. 11 RS

**ENGLISH MEASURE**

Range, 0 to 1"

by thousandths of an inch

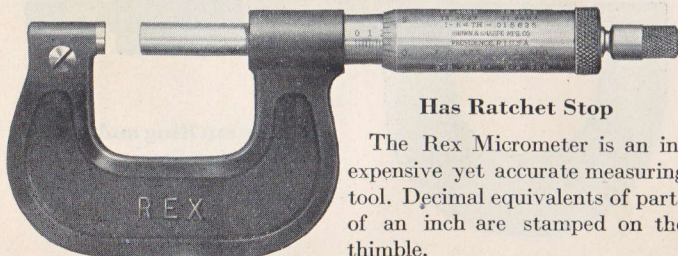
or

**METRIC MEASURE**

Range, 0 to 25 mm

by hundredths of a millimetre

Price, \$6.75 Leather Case, \$1.25



### Has Ratchet Stop

The Rex Micrometer is an inexpensive yet accurate measuring tool. Decimal equivalents of parts of an inch are stamped on the thimble.

Table of decimal equivalents omitted on Metric Micrometer.

Each of the above packed one in a box.



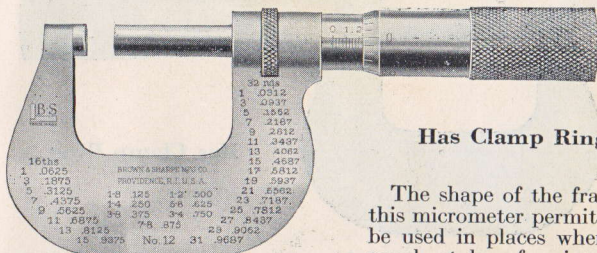
## Micrometer Caliper No. 12

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

Price, \$9.50 Leather Case, \$1.25

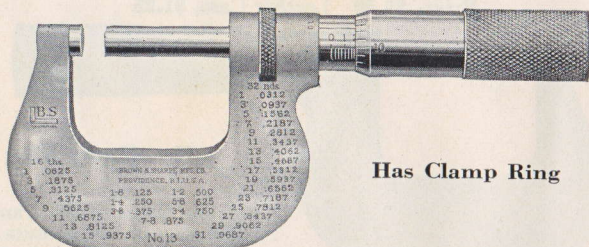


## Micrometer Caliper No. 13

Range, 0 to 1"

by ten-thousandths as well as thousandths of an inch

Price, \$11.25 Leather Case, \$1.25



Has Clamp Ring

The shape of the frame of this micrometer permits it to be used in places where the usual style of micrometer will not enter, the combined thickness of frame and anvil being only 11-32".

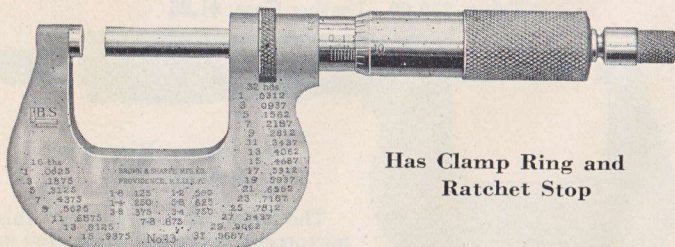
For reading Micrometer with ten-thousandths graduations, see page 9.

## Micrometer Caliper No. 13 RS

Range, 0 to 1"

by ten-thousandths as well as thousandths of an inch

Price, \$11.75 Leather Case, \$1.25



Has Clamp Ring and  
Ratchet Stop

The shape of the frame of this micrometer permits it to be used in places where the usual style of micrometer will not enter, the combined thickness of frame and anvil being only 11-32".

For reading Micrometer with ten-thousandths graduations, see page 9.

Each of the above packed one in a box.



## Micrometer Caliper No. 15

**ENGLISH MEASURE**

or

**METRIC MEASURE**

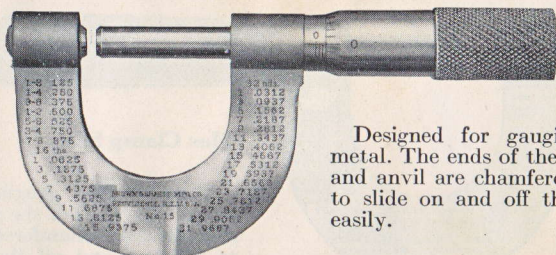
**Range, 0 to 1"**

**Range, 0 to 25 m/m**

by thousandths of an inch

by hundredths of a millimetre

**Price, \$8.50 Leather Case, \$1.25**



Designed for gauging hot metal. The ends of the spindle and anvil are chamfered so as to slide on and off the work easily.

Table of decimal equivalents omitted on Metric Micrometer.

## Micrometer Caliper No. 15 RS

**ENGLISH MEASURE**

or

**METRIC MEASURE**

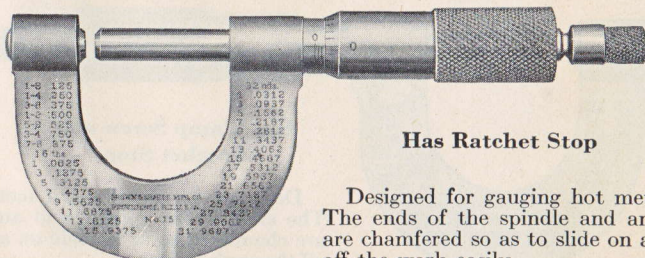
**Range, 0 to 1"**

**Range, 0 to 25 m/m**

by thousandths of an inch

by hundredths of a millimetre

**Price, \$9.00 Leather Case, \$1.25**



**Has Ratchet Stop**

Designed for gauging hot metal. The ends of the spindle and anvil are chamfered so as to slide on and off the work easily.

Table of decimal equivalents omitted on Metric Micrometer.

Each of the above packed one in a box.

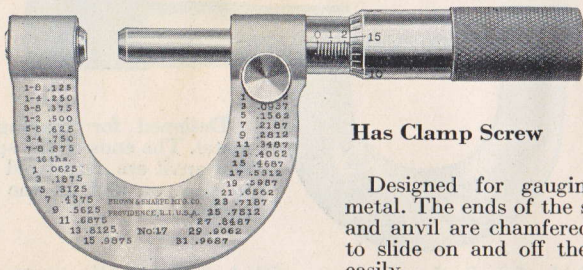
## Micrometer Caliper No. 17

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

Price, \$9.50 Leather Case, \$1.25



**Has Clamp Screw**

Designed for gauging hot metal. The ends of the spindle and anvil are chamfered so as to slide on and off the work easily.

Table of decimal equivalents omitted on Metric Micrometer.

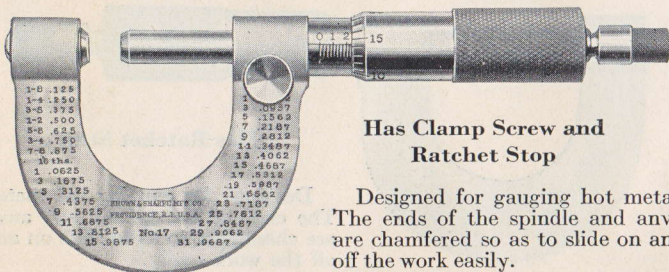
## Micrometer Caliper No. 17 RS

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

Price, \$10.00 Leather Case, \$1.25



**Has Clamp Screw and  
Ratchet Stop**

Designed for gauging hot metal. The ends of the spindle and anvil are chamfered so as to slide on and off the work easily.

Table of decimal equivalents omitted on Metric Micrometer.  
Each of the above packed one in a box.



# Micrometer Calipers Nos. 17 and 17 RS

## With Wooden Handle

No. 17, with Wooden Handle. Price, \$11.00

No. 17 RS, with Wooden Handle. Price, \$11.50



No. 17 has Clamp Screw

No. 17 RS has Clamp Screw  
and Ratchet Stop

The wooden handle with which Micrometer Calipers Nos. 17 and 17 RS can be furnished when desired, attaches to the frame and makes the micrometer much more convenient to use as it keeps the hand a reasonable distance from the hot metal being gauged.

The handle is about 2 3-4" long and about one inch at the largest diameter. When the Nos. 17 and 17 RS Micrometers are furnished with a wooden handle, the clamp screw is provided with wings instead of a knurled head.

Each of the above packed one in a box.

## Micrometer Caliper No. 19

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

Price, \$8.50 Leather Case, \$1.25

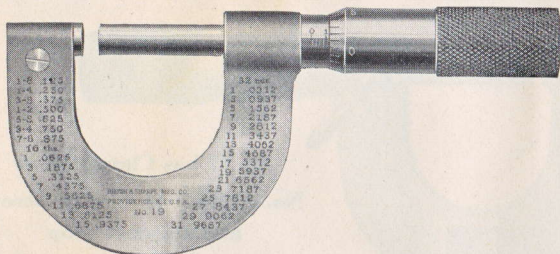


Table of decimal equivalents omitted on Metric Micrometer.

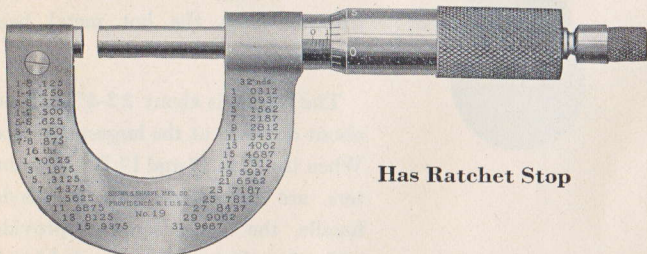
## Micrometer Caliper No. 19 RS

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

Price, \$9.00 Leather Case, \$1.25



Has Ratchet Stop

Table of decimal equivalents omitted on Metric Micrometer.

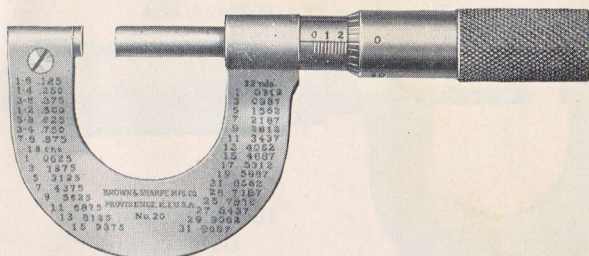
Each of the above packed one in a box.

## Micrometer Caliper No. 20

Range, 0 to 1"

by ten-thousandths as well as thousandths of an inch

Price, \$10.25 Leather Case, \$1.25



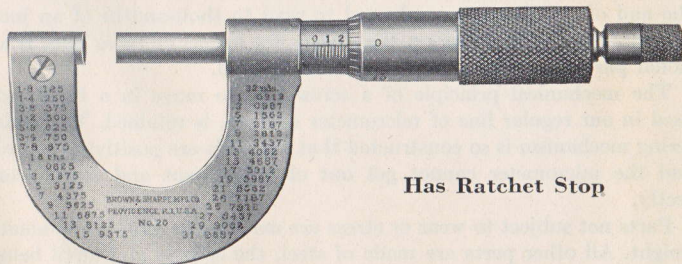
For reading Micrometer with ten-thousandths graduations, see page 9.

## Micrometer Caliper No. 20 RS

Range, 0 to 1"

by ten-thousandths as well as thousandths of an inch

Price, \$10.75 Leather Case, \$1.25



Has Ratchet Stop

For reading Micrometer with ten-thousandths graduations, see page 9.

Each of the above packed one in a box.

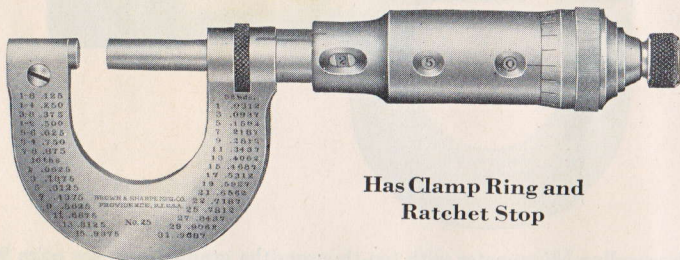


# Direct Reading Micrometer Caliper No. 25

Range, 0 to 1" by thousandths of an inch

Price, in Leather Case, \$22.00

Patented Aug. 22, 1911; May 5, 1914



Has Clamp Ring and  
Ratchet Stop

**T**HIS Micrometer Caliper presents a very desirable feature in that thousandths of an inch can be read in exact figures without the necessity of calculation with the aid of graduation lines. The figures showing in the opening nearest the frame indicate the movement of the spindle by tenths of an inch. Those in the next opening register the movement by hundredths, while the figures in the last opening indicate the movement by thousandths. In addition, the thimble on the end of the sleeve is graduated to read to thousandths of an inch in connection with a line on the sleeve. By means of these lines fractional parts of a thousandth may be estimated.

The mechanical principle of a screw free to move in a fixed nut, used in our regular line of micrometer calipers, is retained. The registering mechanism is so constructed that the dials are positively locked, and the micrometer cannot get out of adjustment and read incorrectly.

Parts not subject to wear or stress are made of an alloy to eliminate weight. All other parts are made of steel, the spindle and anvil being hardened. The caliper may be adjusted to compensate for wear the same as our regular micrometers.

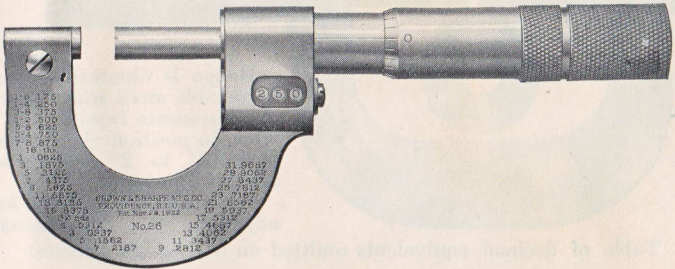
Packed one in a box.

## Direct Reading Micrometer Caliper No. 26

Range, 0 to 1" by thousandths of an inch

Price, \$20.00 Leather Case, \$1.25

Patented November 28, 1922



**T**HIS direct reading micrometer resembles our regular bright frame 1" micrometer and can be easily held and operated with one hand. Measurements are read quickly and easily, and where repeated measurements are to be taken, it is a great timesaver and an aid to accurate work.

The numbers are large and plainly visible. The exact number of thousandths are read directly from the tool at a glance. For closer measurements the graduation lines on the thimble permit the operator to estimate half and quarter thousandths of an inch.

All parts subject to wear are made of steel. Particular attention has been given the indexing mechanism to insure long life and dependability. In addition to means of protection from dirt and grit getting into the mechanism, hardened indexing gears are used, insuring good wearing qualities and smooth action.

When it is necessary to compensate for wear of the measuring screw, a cap on the end of the thimble can be removed to give access to the adjusting nut through an opening in the thimble.

The construction is substantial throughout so that the tool will stand the use ordinarily given a micrometer.

Packed one in a box.

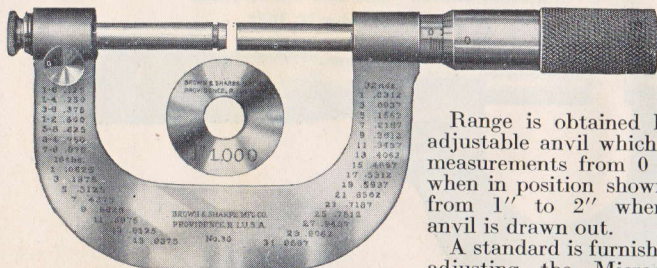
## Micrometer Caliper No. 30

**ENGLISH MEASURE**  
Range, 0 to 2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 50 m/m  
by hundredths of a millimetre

Price, \$12.50 Leather Case, \$1.60



Range is obtained by an adjustable anvil which gives measurements from 0 to 1" when in position shown and from 1" to 2" when the anvil is drawn out.

A standard is furnished for adjusting the Micrometer.

Table of decimal equivalents omitted on Metric Micrometer.

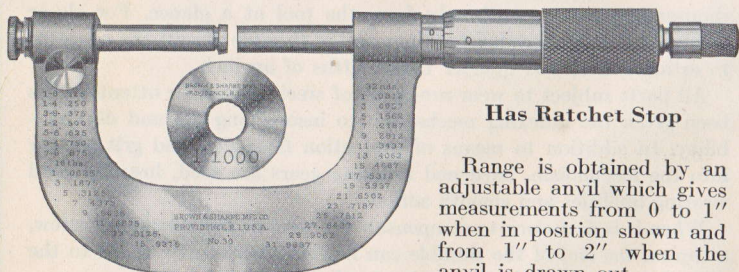
## Micrometer Caliper No. 30 RS

**ENGLISH MEASURE**  
Range, 0 to 2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 50 m/m  
by hundredths of a millimetre

Price, \$13.00 Leather Case, \$1.60



**Has Ratchet Stop**

Range is obtained by an adjustable anvil which gives measurements from 0 to 1" when in position shown and from 1" to 2" when the anvil is drawn out.

A standard is furnished for adjusting the Micrometer. Table of decimal equivalents omitted on Metric Micrometer.

Each of the above packed one in a box.



## Micrometer Caliper No. 38

**ENGLISH MEASURE**

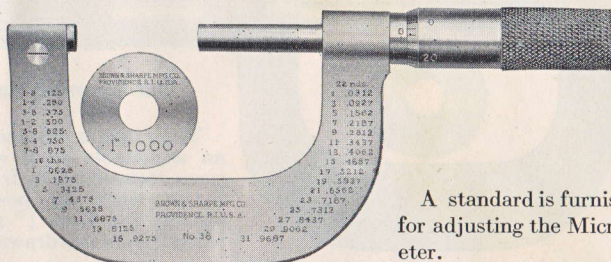
Range, 1" to 2"  
by thousandths of an inch

or

**METRIC MEASURE**

Range, 25 m/m to 50 m/m  
by hundredths of a millimetre

**Price, \$9.50 Leather Case, \$1.60**



A standard is furnished  
for adjusting the Microm-  
eter.

Table of decimal equivalents omitted on Metric Micrometer.

## Micrometer Caliper No. 38 RS

**ENGLISH MEASURE**

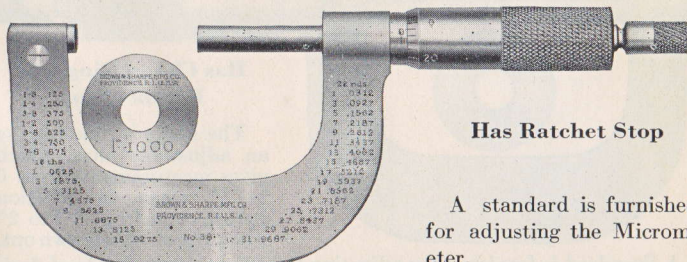
Range, 1" to 2"  
by thousandths of an inch

or

**METRIC MEASURE**

Range, 25 m/m to 50 m/m  
by hundredths of a millimetre

**Price, \$10.00 Leather Case, \$1.60**



**Has Ratchet Stop**

A standard is furnished  
for adjusting the Microm-  
eter.

Table of decimal equivalents omitted on Metric Micrometer.

Each of the above packed one in a box.

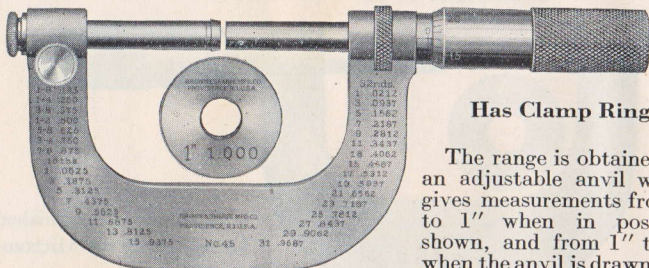
## Micrometer Caliper No. 45

**ENGLISH MEASURE**  
Range, 0 to 2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 50 m/m  
by hundredths of a millimetre

Price, \$13.50 Leather Case, \$1.60



**Has Clamp Ring**

The range is obtained by an adjustable anvil which gives measurements from 0 to 1" when in position shown, and from 1" to 2" when the anvil is drawn out.

A Standard is furnished for adjusting the Micrometer. Table of decimal equivalents omitted on Metric Micrometer.

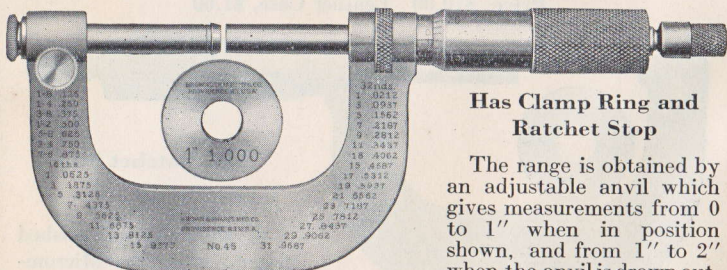
## Micrometer Caliper No. 45 RS

**ENGLISH MEASURE**  
Range, 0 to 2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 50 m/m  
by hundredths of a millimetre

Price, \$14.00 Leather Case, \$1.60



**Has Clamp Ring and  
Ratchet Stop**

The range is obtained by an adjustable anvil which gives measurements from 0 to 1" when in position shown, and from 1" to 2" when the anvil is drawn out.

A Standard is furnished for adjusting the Micrometer. Table of decimal equivalents omitted on Metric Micrometer.

Each of above packed one in a box.

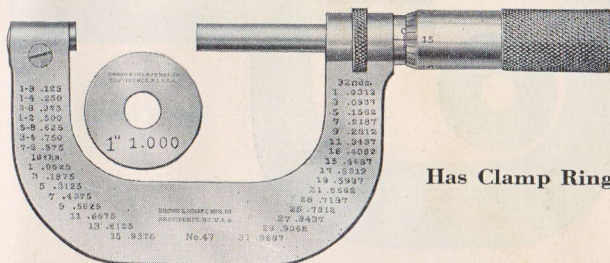
## Micrometer Caliper No. 47

**ENGLISH MEASURE**  
Range, 1" to 2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 25 m/m to 50 m/m  
by hundredths of a millimetre

Price, \$10.50 Leather Case, \$1.60



Has Clamp Ring

A Standard is furnished for adjusting the Micrometer. Table of decimal equivalents omitted on Metric Micrometer.

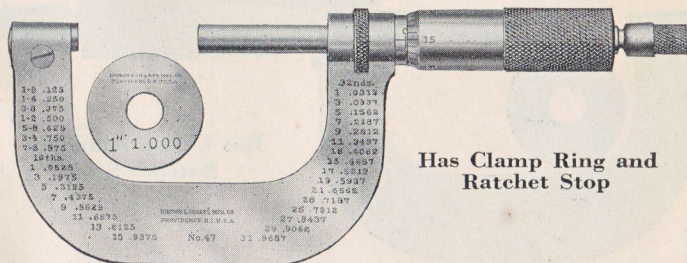
## Micrometer Caliper No. 47 RS

**ENGLISH MEASURE**  
Range, 1" to 2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 25 m/m to 50 m/m  
by hundredths of a millimetre

Price, \$11.00 Leather Case, \$1.60



Has Clamp Ring and  
Ratchet Stop

A Standard is furnished for adjusting the Micrometer. Table of decimal equivalents omitted on Metric Micrometer.

Each of above packed one in a box.

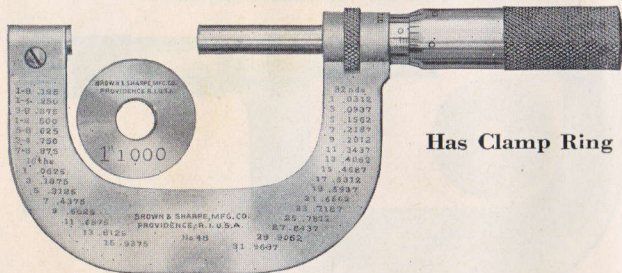


## Micrometer Caliper No. 48

Range, 1" to 2"

by ten-thousandths as well as thousandths of an inch.

Price, \$12.25 Leather Case, \$1.60



Has Clamp Ring

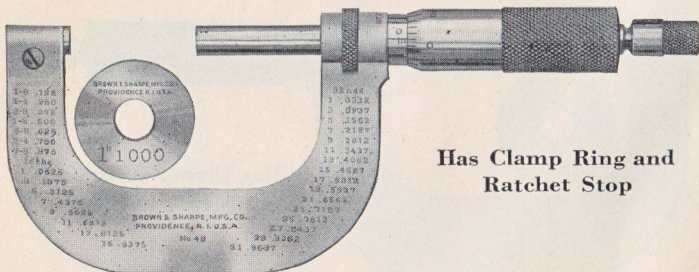
A Standard is furnished for adjusting the Micrometer. For reading Micrometer with ten-thousandths graduations, see page 9.

## Micrometer Caliper No. 48 RS

Range, 1" to 2"

by ten-thousandths as well as thousandths of an inch.

Price, \$12.75 Leather Case, \$1.60



Has Clamp Ring and  
Ratchet Stop

A Standard is furnished for adjusting the Micrometer. For reading Micrometer with ten-thousandths graduations, see page 9.

Each of the above packed one in a box.

## Micrometer Caliper No. 50

**ENGLISH MEASURE**

or

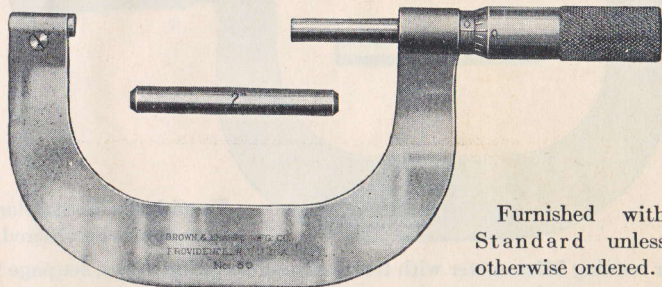
**METRIC MEASURE**

**Range, 2" to 3"**  
by thousandths of an inch

**Range, 50 m/m to 75 m/m**  
by hundredths of a millimetre

**Price**

Without Standard, \$11.50; With Standard, \$12.75; Leather Case, \$3.00



Furnished with  
Standard unless  
otherwise ordered.

## Micrometer Caliper No. 50 RS

**ENGLISH MEASURE**

or

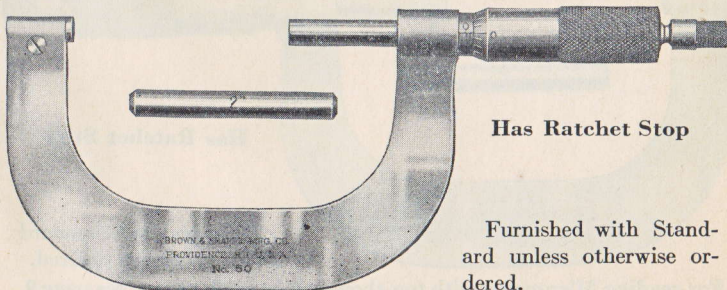
**METRIC MEASURE**

**Range, 2" to 3"**  
by thousandths of an inch

**Range, 50 m/m to 75 m/m**  
by hundredths of a millimetre

**Price**

Without Standard, \$12.00; With Standard, \$13.25; Leather Case, \$3.00



**Has Ratchet Stop**

Furnished with Stand-  
ard unless otherwise or-  
dered.

Each of the above packed one in a box.

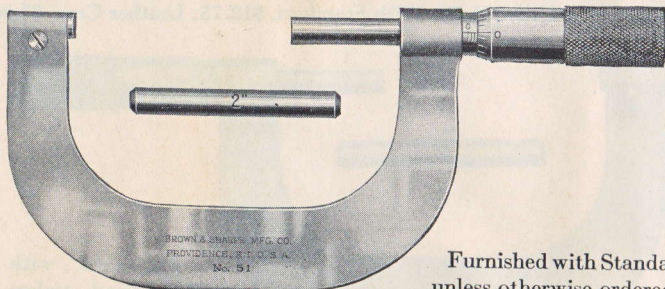
## Micrometer Caliper No. 51

Range, 2" to 3"

by ten-thousandths as well as thousandths of an inch

### Price

Without Standard, \$13.25; With Standard, \$14.50; Leather Case, \$3.00



Furnished with Standard unless otherwise ordered.

For reading Micrometer with ten-thousandths graduations, see page 9.

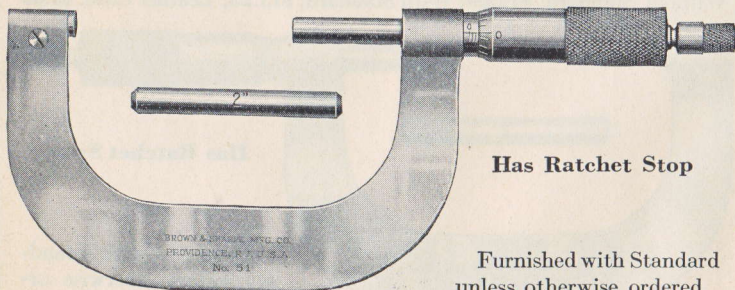
## Micrometer Caliper No. 51 RS

Range, 2" to 3"

by ten-thousandths as well as thousandths of an inch

### Price

Without Standard, \$13.75; With Standard, \$15.00; Leather Case, \$3.00



Has Ratchet Stop

Furnished with Standard unless otherwise ordered.

For reading Micrometer with ten-thousandths graduations, see page 9.

Each of the above packed one in a box.



## Micrometer Caliper No. 52

### ENGLISH MEASURE

Range, 2" to 3"  
by thousandths of an inch

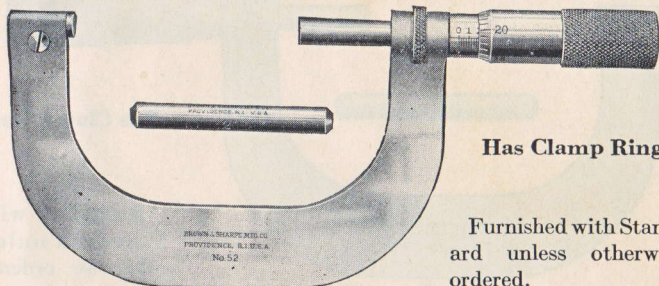
or

### METRIC MEASURE

Range, 50 m/m to 75 m/m  
by hundredths of a millimetre

### Price

Without Standard, \$12.50; With Standard, \$13.75; Leather Case, \$3.00



**Has Clamp Ring**

Furnished with Standard unless otherwise ordered.

## Micrometer Caliper No. 52 RS

### ENGLISH MEASURE

Range, 2" to 3"  
by thousandths of an inch

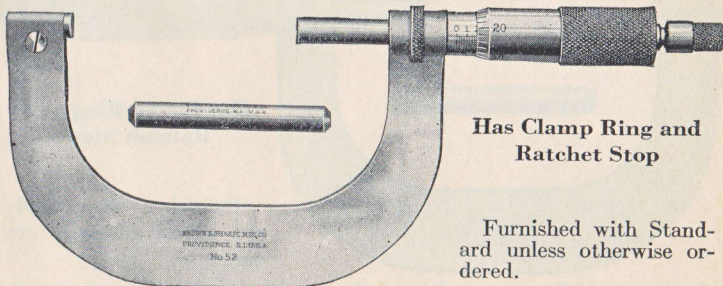
or

### METRIC MEASURE

Range, 50 m/m to 75 m/m  
by hundredths of a millimetre

### Price

Without Standard, \$13.00; With Standard, \$14.25; Leather Case, \$3.00



**Has Clamp Ring and Ratchet Stop**

Furnished with Standard unless otherwise ordered.

Each of the above packed one in a box.

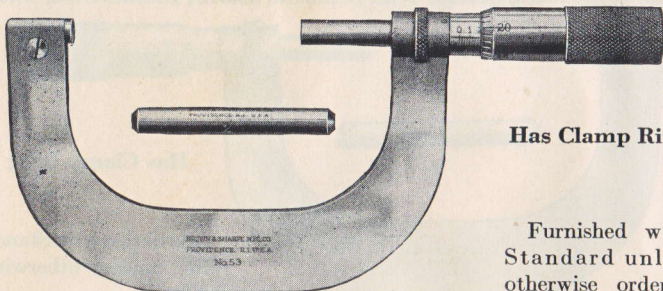
## Micrometer Caliper No. 53

Range, 2" to 3"

by ten-thousandths as well as thousandths of an inch

Price

Without Standard, \$14.25; With Standard, \$15.50; Leather Case, \$3.00



Has Clamp Ring

Furnished with Standard unless otherwise ordered.

For reading Micrometer with ten-thousandths graduations, see page 9.

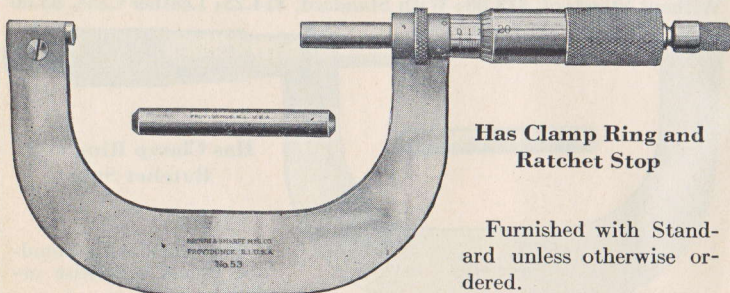
## Micrometer Caliper No. 53 RS

Range, 2" to 3"

by ten-thousandths as well as thousandths of an inch

Price

Without Standard, \$14.75; With Standard, \$16.00; Leather Case, \$3.00



Has Clamp Ring and Ratchet Stop

Furnished with Standard unless otherwise ordered.

For reading Micrometer with ten-thousandths graduations, see page 9.  
Each of the above packed one in a box.

## Micrometer Caliper No. 55

### ENGLISH MEASURE

Range, 2" to 6"

by thousandths of an inch

Measures work 6" in diameter

or

### METRIC MEASURE

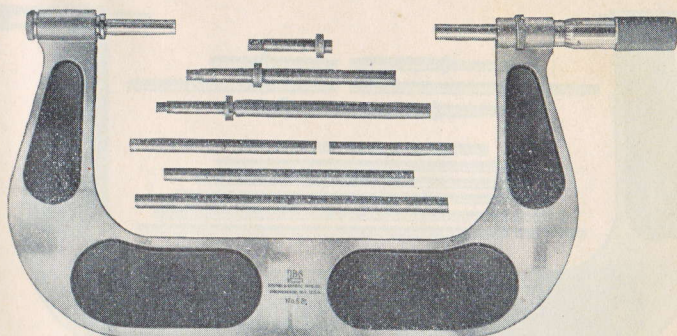
Range, 50 m/m to 150 m/m

by hundredths of a millimetre

Measures work 150 m/m in diameter

Price	{ Without Ratchet Stop	{ Without Standards, \$20.00
		{ With Standards, 26.50
	{ With Ratchet Stop . .	{ Without Standards, 20.50
		{ With Standards, 27.00

Price includes a finished wooden case.



With or Without Ratchet Stop

Micrometer Caliper No. 55 is particularly adapted to measuring pistons in motor service work. Its broad range of measurements from 2" to 6", by thousandths of an inch, covers all pistons ordinarily used.

The range of measurement is obtained by the four changeable anvils. These anvils are easily and quickly changed and held positively in place by a knurled nut. Each anvil has separate means of adjustment for wear.

By use of the different anvils measurements from 2" to 3", 3" to 4", 4" to 5", and 5" to 6", English Measure; or 50 m/m to 75 m/m, 75 m/m to 100 m/m, 100 m/m to 125 m/m, and 125 m/m to 150 m/m, Metric Measure, can be taken.

A set of four Standards is furnished unless otherwise ordered.

Packed one in a box.



## Micrometer Caliper No. 57

### ENGLISH MEASURE

Range, 6" to 12"

by thousandths of an inch

Measures work 12" in diameter

or

### METRIC MEASURE

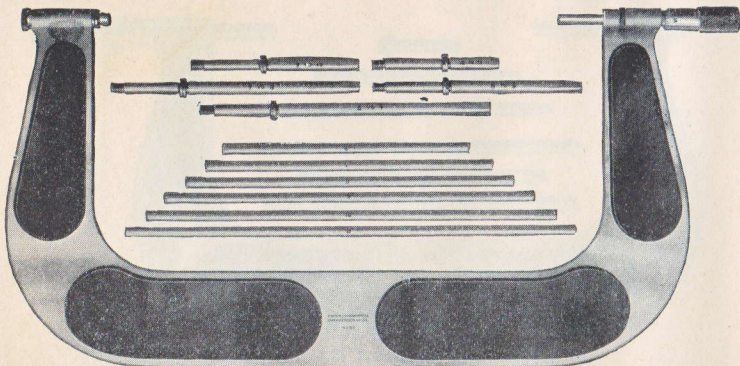
Range, 150 m/m to 300 m/m

by hundredths of a millimetre

Measures work 300 m/m in diameter

Price	{	Without Ratchet Stop	{ Without Standards, \$37.50
			{ With Standards, 54.75
	{	With Ratchet Stop.	{ Without Standards, 38.00
			{ With Standards, 55.25

Price includes a finished wooden case.



With or Without Ratchet Stop

Micrometer Caliper No. 57 measures all sizes from 6" to 12" by thousandths of an inch. The range of measurement is obtained by the changeable anvils furnished. These anvils are easily and quickly changed and held positively in place by a knurled nut. Each anvil has separate means of adjustment for wear. By use of the different anvils measurements from 6" to 7", 7" to 8", 8" to 9", 9" to 10", 10" to 11", and 11" to 12", English Measure; or, 150 m/m to 175 m/m, 175 m/m to 200 m/m, 200 m/m to 225 m/m, 225 m/m to 250 m/m, 250 m/m to 275 m/m, and 275 m/m to 300 m/m, Metric Measure, can be taken.

A set of six Standards is furnished unless otherwise ordered.

Packed one in a box.

## Rex

### Micrometer Calipers Nos. 59 to 88

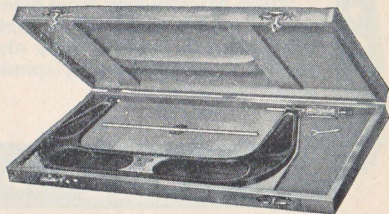
**R**EX Micrometer Calipers are highly accurate Brown & Sharpe Precision Tools having the popular black japanned frames in sizes to measure from 0 to 24". While many will prefer the more expensive finish in the Brown & Sharpe toolmakers' line of bright frame micrometers in the smaller sizes, the Rex Micrometers are thoroughly reliable in every way and have the same high accuracy of all Brown & Sharpe Micrometers.

The frames are of I-section to give the greatest rigidity and strength with lightness. A feature of the design is the shape of the frame which gives greater measuring capacity than frames of the circular type.

These Micrometers are regularly furnished with a Clamp Ring which clamps the spindle and preserves the setting. The construction of the anvil, spindle, thimble, and other parts is similar to the regular bright frame Brown & Sharpe Micrometers with means provided for adjustment for wear of both the measuring surfaces and screw. They are furnished for either English or Metric Measure and with or without Ratchet Stops.

Rex Micrometers are made up in sets of several ranges of measurement. These sets have been selected as ones convenient and appropriate for ordinary requirements and are listed on pages 46 to 50, inclusive.

Rex Micrometer Calipers, in sizes from 71 to 88, are furnished in nicely finished wooden cases that will be found convenient for shop use and well adapted to protect the tools.

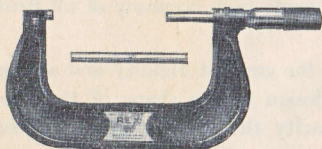


# Rex Micrometer Calipers Nos. 59 to 88



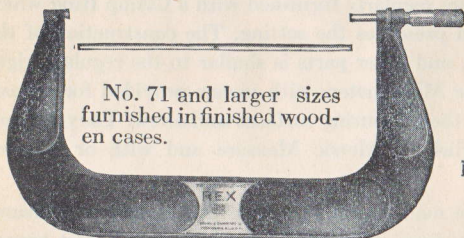
**Rex Micrometer Caliper No. 59**

**Has Clamp Ring**



**Rex Micrometer Calipers  
Nos. 61 to 65**

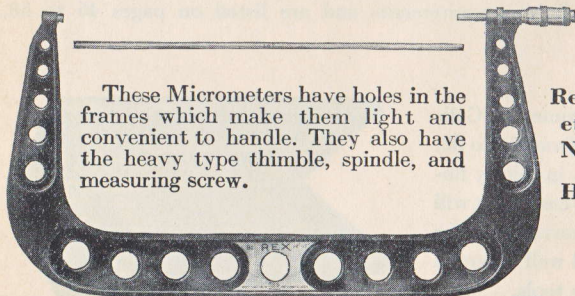
**Have Clamp Rings**



No. 71 and larger sizes  
furnished in finished wooden  
cases.

**Rex Micrometer  
Calipers  
Nos. 67 to 76**

**Have Clamp Rings**



These Micrometers have holes in the  
frames which make them light and  
convenient to handle. They also have  
the heavy type thimble, spindle, and  
measuring screw.

**Rex Microm-  
eter Calipers  
Nos. 77 to 88**

**Have Clamp  
Rings**



# Rex Micrometer Calipers Nos. 59 to 88

**ENGLISH MEASURE**
**or**
**METRIC MEASURE**
**Range, 0 to 24"**
**Range, 0 to 600 m/m**

by thousandths of an inch

by hundredths of a millimetre

Regularly furnished with Clamp Rings.

No.	Range		Price	
	English Measure	Metric Measure	Without Standards	With Standards
59	0 to 1"	0 to 25 m/m	\$6.75	....
61	1" to 2	25 m/m to 50	7.50	\$8.50
63	2 to 3	50 to 75	8.25	9.50
65	3 to 4	75 to 100	9.00	10.50
67	4 to 5	100 to 125	9.75	11.50
69	5 to 6	125 to 150	10.50	12.50
71	6 to 7	150 to 175	11.50	13.75
72	7 to 8	175 to 200	12.50	15.00
73	8 to 9	200 to 225	13.50	16.25
74	9 to 10	225 to 250	14.50	17.50
75	10 to 11	250 to 275	15.50	18.75
76	11 to 12	275 to 300	16.50	20.00
77	12 to 13	300 to 325	17.50	21.25
78	13 to 14	325 to 350	18.50	22.75
79	14 to 15	350 to 375	19.50	24.00
80	15 to 16	375 to 400	21.50	26.25
81	16 to 17	400 to 425	23.50	28.50
82	17 to 18	425 to 450	25.50	30.75
83	18 to 19	450 to 475	27.50	33.00
84	19 to 20	475 to 500	30.50	36.75
85	20 to 21	500 to 525	33.50	40.50
86	21 to 22	525 to 550	36.50	44.25
87	22 to 23	550 to 575	39.50	48.00
88	23 to 24	575 to 600	42.50	51.75

For Ratchet Stop, add 50 cents to above prices.

Rex Micrometer Calipers Nos. 59, 61, 63 and 65 can be furnished to read to **ten-thousandths** as well as thousandths of an inch at an additional cost of \$1.50 each.

## Leather Cases

Leather Cases can be furnished for Rex Micrometers at the prices given in the list below.

Tool No.....	59	61	63	65	67	69
Price of Case. ....	\$1.25	\$2.50	\$3.00	\$3.50	\$4.00	\$4.75

Each of the above packed one in a box.

## Heavy Micrometer Calipers Nos. 100, 102 and 104

These Micrometers are designed to meet the demands of constant and severe uses, under adverse conditions, such as the dirt and moisture of grinding rooms or wherever it is desired to take frequent measurements with the Clamp Ring set.

They are made with a frame of heavy I-section, and with a much heavier spindle and threaded portion than is generally used in Micrometers. This gives greater stiffness and insures longer life to the screw under adverse conditions, because of the larger bearing surface for the threads.

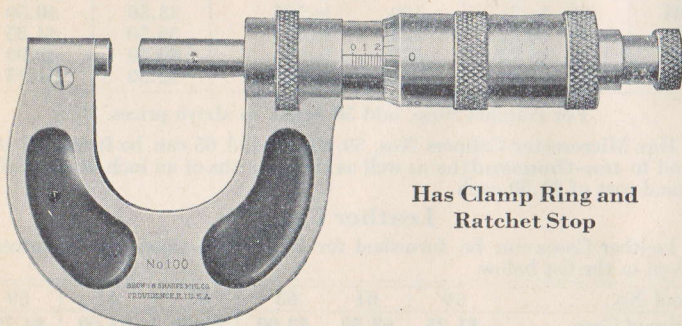
### Heavy Micrometer Caliper No. 100

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

**Price, \$12.00 Leather Case, \$2.25**



**Has Clamp Ring and  
Ratchet Stop**

**Packed one in a box.**

## Heavy Micrometer Caliper No. 102

**ENGLISH MEASURE**

Range, 1" to 2"

by thousandths of an inch

or

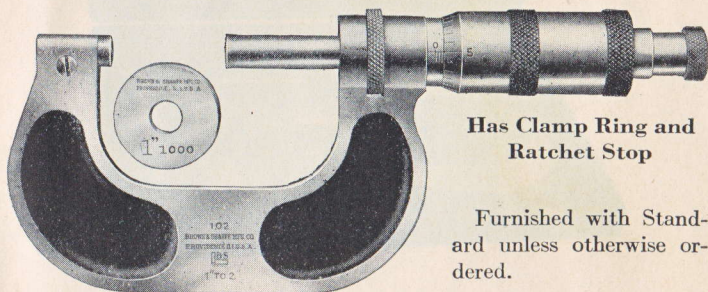
**METRIC MEASURE**

Range, 25 m/m to 50 m/m

by hundredths of a millimetre

### Price

Without Standard, \$13.25; With Standard, \$14.75; Leather Case, \$2.50



**Has Clamp Ring and  
Ratchet Stop**

Furnished with Stand-  
ard unless otherwise or-  
dered.

## Heavy Micrometer Caliper No. 104

**ENGLISH MEASURE**

Range, 2" to 3"

by thousandths of an inch

or

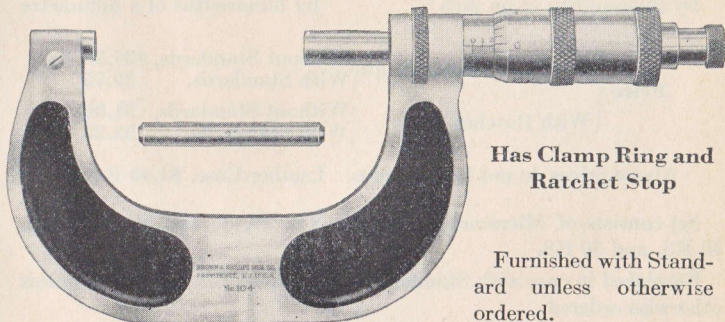
**METRIC MEASURE**

Range, 50 m/m to 75 m/m

by hundredths of a millimetre

### Price

Without Standard, \$14.50; With Standard, \$15.75; Leather Case, \$3.00

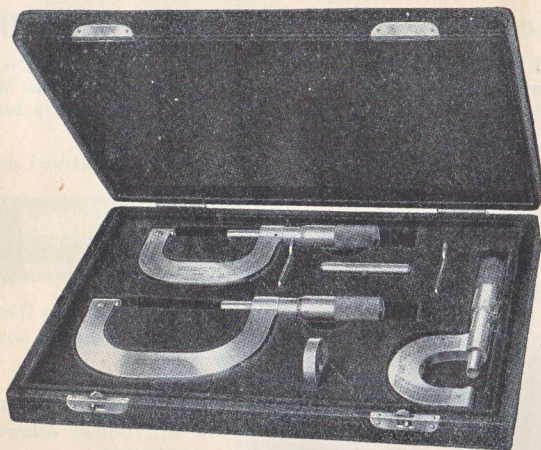


**Has Clamp Ring and  
Ratchet Stop**

Furnished with Stand-  
ard unless otherwise or-  
dered.

Each of above packed one in a box.





## Micrometer Caliper Set No. 130

3 Micrometers

With or Without Ratchet Stops

**ENGLISH MEASURE**  
Range, 0 to 3"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 75 m/m  
by hundredths of a millimetre

Price	{ Without Ratchet Stops	{ Without Standards, \$29.50
		{ With Standards, 30.75
	{ With Ratchet Stops . .	{ Without Standards, 31.00
		{ With Standards, 32.25

Above prices do not include case. Leather Case, \$4.00 Extra

Set consists of Micrometer Calipers Nos. 19, 38 and 50 or 19 RS, 38 RS, and 50 RS.

Furnished in case with Standards, and without Ratchet Stops unless otherwise ordered.

Packed one set in a box.

## Micrometer Caliper Set No. 131

### 3 Micrometers

With Clamp Rings and With or Without Ratchet Stops

ENGLISH MEASURE	or	METRIC MEASURE
Range, 0 to 3"		Range, 0 to 75 m/m
by thousandths of an inch		by hundredths of a millimetre

Price	Without Ratchet Stops	Without Standards, \$32.50
		With Standards, 33.75
	With Ratchet Stops	Without Standards, 34.00
		With Standards, 35.25

Above prices do not include case. Leather Case, \$4.00 Extra

Set consists of Micrometer Calipers Nos. 8, 47 and 50 or 8 RS, 47 RS and 50 RS.

Furnished in case, with Standards and without Ratchet Stops unless otherwise ordered.

## Micrometer Caliper Set No. 132

### 3 Micrometers

With Clamp Rings and With or Without Ratchet Stops

Range, 0 to 3"  
by ten-thousandths as well as thousandths of an inch

Price	Without Ratchet Stops	Without Standards, \$37.75
		With Standards, 39.00
	With Ratchet Stops	Without Standards, 39.25
		With Standards, 40.50

Above prices do not include case. Leather Case, \$4.00 Extra

Set consists of Micrometer Calipers Nos. 10, 48 and 53 or 10 RS, 48 RS and 53 RS.

Furnished in case, with Standards and without Ratchet Stops unless otherwise ordered.

Each of the above packed one set in a box.



## Rex Micrometer Caliper Set No. 133

3 Micrometers

With Clamp Rings and With or Without Ratchet Stops

**ENGLISH MEASURE**  
Range, 0 to 3"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 75 m/m  
by hundredths of a millimetre

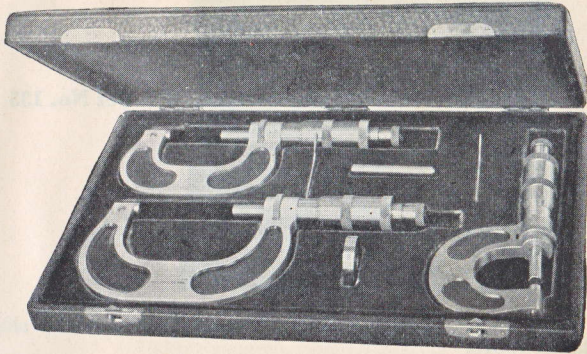
Price	{ Without Ratchet Stops	Without Standards, \$22.50
		With Standards, 24.75
	{ With Ratchet Stops..	Without Standards, 24.00
		With Standards, 26.25

Above prices do not include case. Leather Case, \$4.00 Extra

Set consists of Rex Micrometers, Nos. 59, 61 and 63. Furnished in case with Standards, and without Ratchet Stops unless otherwise ordered.

Packed one set in a box.





## Heavy Micrometer Caliper Set No. 134

3 Micrometers

With Clamp Rings and With Ratchet Stops

**ENGLISH MEASURE**

Range, 0 to 3"

by thousandths of an inch

or

**METRIC MEASURE**

Range, 0 to 75 m/m

by hundredths of a millimetre

### Price

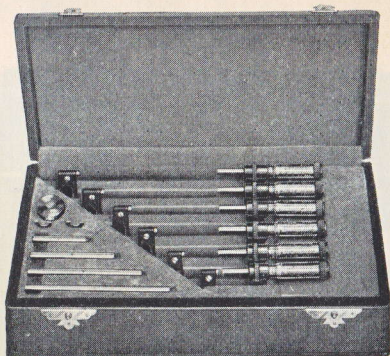
Without Standards, \$39.75

With Standards, \$42.00

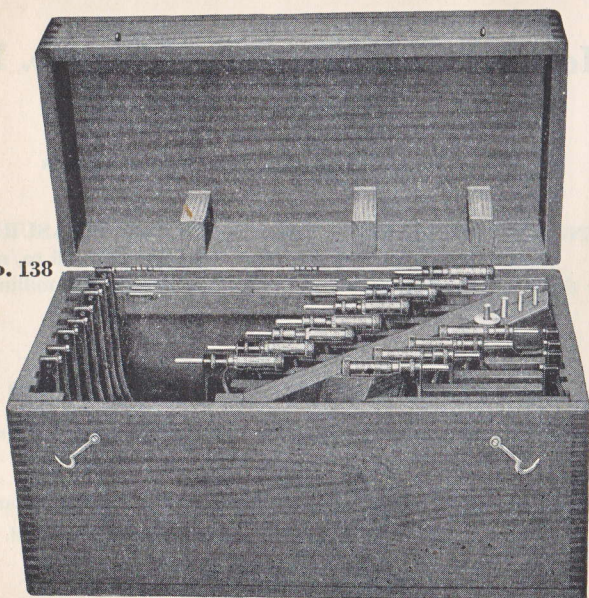
Above prices do not include case. Leather Case, \$5.00 Extra

Set consists of Heavy Micrometer Calipers Nos. 100, 102, and 104.  
Furnished in case and with Standards unless otherwise ordered.

Packed one set in a box.

**Set No. 135**

Set No. 137 is furnished in a finished wooden case of similar shape to that shown above.

**Set No. 138**



## Rex Micrometer Caliper Set No. 135

6 Micrometers

With Clamp Rings and With or Without Ratchet Stops

**ENGLISH MEASURE**

or

**METRIC MEASURE**

Range, 0 to 6"

Range, 0 to 150 m/m

by thousandths of an inch

by hundredths of a millimetre

Price	{ Without Ratchet Stops	Without Standards, \$51.75
		With Standards, 59.25
	{ With Ratchet Stops . . .	Without Standards, 54.75
		With Standards, 62.25

Above prices do not include case. Leather Case, \$7.50 Extra.

Set consists of Rex Micrometers Nos. 59, 61, 63, 65, 67 and 69. Furnished with Standards, in case and without Ratchet Stops unless otherwise ordered.

## Rex Micrometer Caliper Set No. 137

6 Micrometers

With Clamp Rings and With or Without Ratchet Stops

**ENGLISH MEASURE**

or

**METRIC MEASURE**

Range, 6" to 12"

Range, 150 m/m to 300 m/m

by thousandths of an inch

by hundredths of a millimetre

Price	{ Without Ratchet Stops	Without Standards, \$90.00
		With Standards, 107.25
	{ With Ratchet Stops . . .	Without Standards, 93.00
		With Standards, 110.25

Set consists of Rex Micrometers Nos. 71, 72, 73, 74, 75 and 76, and is furnished in a finished wooden case. Furnished with Standards and without Ratchet Stops unless otherwise ordered.

## Rex Micrometer Caliper Set No. 138

12 Micrometers

With Clamp Rings and With or Without Ratchet Stops

**ENGLISH MEASURE**

or

**METRIC MEASURE**

Range, 0 to 12"

Range, 0 to 300 m/m

by thousandths of an inch

by hundredths of a millimetre

Price	{ Without Ratchet Stops	Without Standards, \$145.25
		With Standards, 170.00
	{ With Ratchet Stops . . .	Without Standards, 151.25
		With Standards, 176.00

Set consists of Rex Micrometers Nos. 59, 61, 63, 65, 67, 69, 71, 72, 73, 74, 75 and 76, and is furnished in a finished wooden case. Furnished with Standards and without Ratchet Stops unless otherwise ordered.

Each of the above packed one set in a box.



## Rex Micrometer Caliper Set No. 139

6 Micrometers

With Clamp Rings and With or Without Ratchet Stops

**ENGLISH MEASURE**

Range, 12" to 18"

by thousandths of an inch

or

**METRIC MEASURE**

Range, 300 m/m to 450 m/m

by hundredths of a millimetre

Price	{ Without Ratchet Stops	Without Standards, \$135.50
		With Standards, 163.00
	{ With Ratchet Stops. .	Without Standards, 138.50
		With Standards, 166.00

Set consists of Rex Micrometers Nos. 77, 78, 79, 80, 81 and 82, and is furnished in a finished wooden case.

Furnished with Standards and without Ratchet Stops unless otherwise ordered.

## Rex Micrometer Caliper Set No. 140

6 Micrometers

With Clamp Rings and With or Without Ratchet Stops

**ENGLISH MEASURE**

Range, 18" to 24"

by thousandths of an inch

or

**METRIC MEASURE**

Range, 450 m/m to 600 m/m

by hundredths of a millimetre

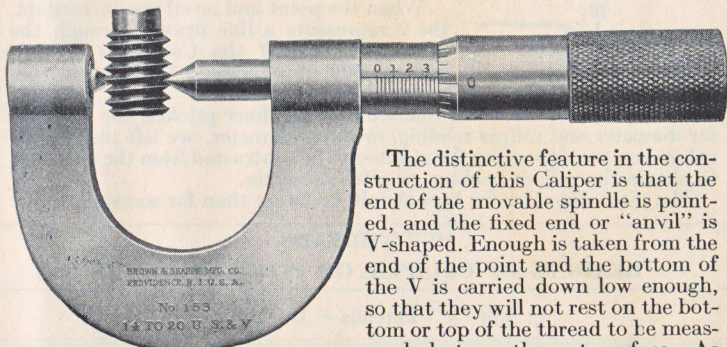
Price	{ Without Ratchet Stops	Without Standards, \$218.75
		With Standards, 263.00
	{ With Ratchet Stops. .	Without Standards, 221.75
		With Standards, 266.00

Set consists of Rex Micrometers Nos. 83, 84, 85, 86, 87 and 88, and is furnished in a finished wooden case.

Furnished with Standards and without Ratchet Stops unless otherwise ordered.

Each of the above packed one set in a box.

# Screw Thread Micrometer Calipers Nos. 150, 152, 153, 154, 155, 156, 157, 158 and 159



The distinctive feature in the construction of this Caliper is that the end of the movable spindle is pointed, and the fixed end or "anvil" is V-shaped. Enough is taken from the end of the point and the bottom of the V is carried down low enough, so that they will not rest on the bottom or top of the thread to be measured, but on the cut surface. As

the thread itself is measured, it will be seen that the actual outside diameter of the piece does not enter into consideration. And as one-half of the depth of the thread from the top on each side is measured, the diameter of the thread as indicated by the Caliper, or the pitch diameter, is the full size of the thread less the depth of one thread.

No.	Capacity, Inches	Range Per Inch		Form of Thread	Price	Price of Case
150	1-2	48	to 64 Thds.	V or U. S. Standard	\$11.50	\$1.20
*152	1	8	to 13 Thds.		12.00	1.25
153	1	14	to 20 Thds.		12.00	1.25
154	1	22	to 30 Thds.	V, United States or Whitworth Standard	12.00	1.25
155	1	32	to 40 Thds.		12.00	1.25
156	2	4 1-2	to 7 Thds.		14.50	1.60
*157	2	8	to 13 Thds.		14.50	1.60
158	2	14	to 20 Thds.		14.50	1.60
159	2	22	to 30 Thds.		14.50	1.60

\*Whitworth Standard range 8 to 12 threads per inch only.

A Standard is furnished for adjusting the 2" Micrometers.

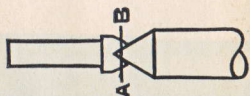
**Metric Measure.** Also furnished in corresponding metric sizes for V, United States or Whitworth Standard Threads.

Special Screw Thread Micrometers made to order. Prices on Application.

Each of the above packed one in a box.



## Tables for Use with Screw Thread Micrometer Calipers



When the point and anvil are in contact, the 0 represents a line drawn through the plane AB, and if the Caliper is opened, say to .500, it represents the distance between the two planes .500" apart.

As there is no standard of diameter for the finer pitches, the columns for diameter and caliper reading, or pitch diameter, are left blank. The column on the right gives the number to be subtracted from the diameter to obtain the caliper reading, or pitch diameter.

The pitch diameter for taps should be larger than for screws.

### "V" THREADS

#### READING OF CALIPER, OR PITCH DIAMETER

$$\text{For "V" Threads} = D - \frac{.866}{N}$$

Diam.	Threads Per Inch	Caliper Reading or Pitch Diam.		Diam. *	Threads Per Inch	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.866}{N}$	$\frac{.866}{N}$	D	N	$D - \frac{.866}{N}$	$\frac{.866}{N}$
	64		.0135	1-4"	24	.2139	.0361
	62		.0140	1-4	20	.2067	.0433
	60		.0144	5-16	20	.2692	.0433
	58		.0149	5-16	18	.2644	.0481
	56		.0155	3-8	18	.3269	.0481
	54		.0160	3-8	16	.3209	.0541
	52		.0167	7-16	16	.3834	.0541
	50		.0173	7-16	14	.3756	.0619
	48		.0180	1-2	14	.4381	.0619
	46		.0188	1-2	13	.4334	.0666
	44		.0197	1-2	12	.4278	.0722
	42		.0206	9-16	14	.5006	.0619
	40		.0217	9-16	12	.4903	.0722
	38		.0228	5-8	11	.5463	.0787
	36		.0241	5-8	10	.5384	.0866
	34		.0255	11-16	10	.6009	.0866
	32		.0271	3-4	10	.6634	.0866
	30		.0289	7-8	9	.7788	.0962
	28		.0309	1	8	.8918	.1082
	26		.0333	1 1-8	8	1.0168	.1082
				1 1-4	7	1.1263	.1237
				1 1-2	6	1.3557	.1443

\*These figures give the outside diameter for screws with threads cut theoretically sharp. As it is not practical to make these threads sharp, the outside diameter will measure less than the figures given, the pitch diameter remaining the same.



# Table for Use with Screw Thread Micrometer Calipers

## U. S. STANDARD THREADS

### READING OF CALIPER, OR PITCH DIAMETER

$$\text{For U. S. Threads} = D - \frac{.6495}{N}$$

Diam.	Threads Per Inch	Caliper Reading or Pitch Diam.		Diam., Inches	Threads Per Inch	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$	D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$
	64		.0101	1-4	20	.2175	.0325
	62		.0105	5-16	18	.2764	.0361
	60		.0103	3-8	16	.3344	.0406
	58		.0112	7-16	14	.3911	.0464
	56		.0116	1-2	13	.4501	.0499
	54		.0120	9-16	12	.5084	.0541
	52		.0125	5-8	11	.5660	.0590
	50		.0130	3-4	10	.6851	.0649
	48		.0135	7-8	9	.8029	.0721
	46		.0141	1	8	.9188	.0812
	44		.0148	1 1-8	7	1.0322	.0928
	42		.0155	1 1-4	7	1.1572	.0928
	40		.0162	1 3-8	6	1.2668	.1082
	38		.0171	1 1-2	6	1.3918	.1082
	36		.0180	1 5-8	5 1-2	1.5070	.1180
	34		.0191	1 3-4	5	1.6201	.1299
	32		.0203	1 7-8	5	1.7451	.1299
	30		.0217	2	4 1-2	1.8557	.1443
	28		.0232	2 1-2	4	2.3376	.1624
	26		.0250	3	3 1-2	2.8145	.1855
	24		.0271	3 1-2	3 1-4	3.3002	.1998
	22		.0295	4	3	3.7835	.2165

## S. A. E. STANDARD THREADS

Same Form of Thread as the United States Standard

### READING OF CALIPER, OR PITCH DIAMETER

$$\text{For S. A. E. Threads} = D - \frac{.6495}{N}$$

Diam., Inches	Threads per Inch	Caliper Reading or Pitch Diam.		Diam., Inches	Threads per Inch	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$	D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$
1-4	28	.2268	.0232	3-4	16	.7094	.0406
5-16	24	.2854	.0271	7-8	14	.8286	.0464
3-8	24	.3479	.0271	1	14	.9536	.0464
7-16	20	.4050	.0324	1 1-8	12	1.0709	.0541
1-2	20	.4675	.0324	1 1-4	12	1.1959	.0541
9-16	18	.5265	.0360	1 3-8	12	1.3209	.0541
5-8	18	.5890	.0360	1 1-2	12	1.4459	.0541
11-16	16	.6469	.0406	...	..	...	...

Table for Use with Screw Thread  
Micrometer Calipers

WHITWORTH STANDARD THREADS

READING OF CALIPER, OR PITCH DIAMETER

For Whitworth Threads =  $D - \frac{.640}{N}$

Diam.	Threads Per Inch	Caliper Reading or Pitch Diam.		Diam., Inches	Threads Per Inch	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.640}{N}$	$\frac{.640}{N}$	D	N	$D - \frac{.640}{N}$	$\frac{.640}{N}$
	48		.0133	1-2	12	.4467	.0533
	46		.0139	9-16	12	.5092	.0533
	44		.0146	5-8	11	.5668	.0582
	42		.0152	11-16	11	.6293	.0582
	40		.0160	3-4	10	.6860	.0640
	38		.0168	13-16	10	.7485	.0640
	36		.0178	7-8	9	.8039	.0711
	34		.0188	15-16	9	.8664	.0711
	32		.0200	1	8	.9200	.0800
	30		.0213	1 1-8	7	1.0336	.0914
	28		.0229	1 1-4	7	1.1586	.0914
	26		.0246	1 3-8	6	1.2684	.1066
	24		.0267	1 1-2	6	1.3934	.1066
	22		.0291	1 5-8	5	1.4970	.1280
1-4	20	.2180	.0320	1 3-4	5	1.6220	.1280
5-16	18	.2769	.0355	1 7-8	4 1-2	1.7328	.1422
3-8	16	.3350	.0400	2	4 1-2	1.8578	.1422
7-16	14	.3918	.0457	2 1-8	4 1-2	1.9828	.1422

A. S. M. E. STANDARD THREADS

Same Form of Thread as the United States Standard

READING OF CALIPER, OR PITCH DIAMETER

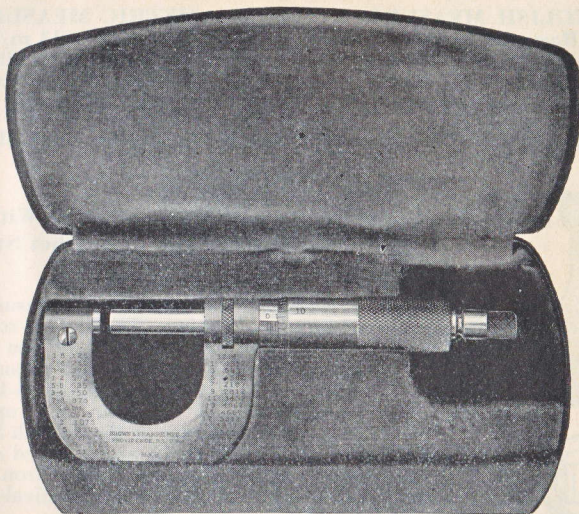
For A. S. M. E. Threads =  $D - \frac{.6495}{N}$

No.	Basic and Max. Outside Diam.	Threads per Inch	Caliper Reading or Max. Pitch Diam.		No.	Basic and Max. Outside Diam.	Threads per Inch	Caliper Reading or Max. Pitch Diam.	
	D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$		D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$
0	.060	80	.0519	.0081	12	.216	28	.1928	.0232
1	.073	72	.0640	.0090	14	.242	24	.2149	.0271
2	.086	64	.0759	.0101	16	.268	22	.2385	.0295
3	.099	56	.0874	.0116	18	.294	20	.2615	.0325
4	.112	48	.0985	.0135	20	.320	20	.2875	.0325
5	.125	44	.1102	.0148	22	.346	18	.3099	.0361
6	.138	40	.1218	.0162	24	.372	16	.3314	.0406
7	.151	36	.1330	.0180	26	.398	16	.3574	.0406
8	.164	36	.1460	.0180	28	.424	14	.3776	.0464
9	.177	32	.1567	.0203	30	.450	14	.4036	.0464
10	.190	30	.1684	.0217	..	....	..	.....	.....



# Micrometer Cases Nos. 202 and 203

Price, 75 cents



These micrometer cases are light and handy and protect the micrometer from dirt and grit. They fit the pocket nicely, are not big and clumsy and do not cause the pocket to bulge.

Each case is substantially made of steel with a strong spring cover, plush lined and covered with imitation leather.

## Case No. 202

For Micrometers Nos. { 8 10 15 17 19 20  
8 RS, 10 RS, 15 RS, 17 RS, 19 RS, 20 RS

## Case No. 203

For Micrometers Nos. { 11 12 13 59  
11 RS, 12 RS, 13 RS

## Soft Leather Cases For Micrometer Calipers

Price, 50 cents

These Soft Leather Cases are made to hold micrometer calipers of 1-2", 1", and 2" capacity. When ordering give size of caliper with which case is to be used.



# Micrometer Caliper No. 225

For Measuring the Thickness of Tubing

## ENGLISH MEASURE

Range, 0 to 1-2"

by thousandths of an inch  
for tubing 5-16" inside  
dia. and upward

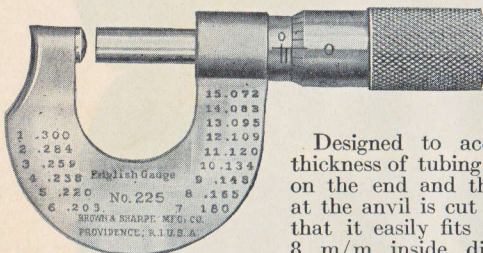
or

## METRIC MEASURE

Range, 0 to 13 m/m

by hundredths of a millimetre  
for tubing 8 m/m inside  
dia. and upward

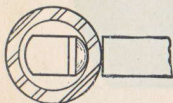
Price, \$8.00; With Ratchet Stop, \$8.50; Leather Case, \$1.20.



With or Without  
Ratchet Stop

Designed to accurately measure the thickness of tubing. The anvil is rounded on the end and the back of the frame at the anvil is cut away and rounded so that it easily fits into tubing 5-16" or 8 m/m inside diameter and upward.

Decimal equivalents of the English Standard Gauge from Nos. 1 to 15 are stamped on the frame. (See Birmingham or Stub's Iron Wire Table, page 174.) Table of decimal equivalents is omitted on Metric Micrometer.

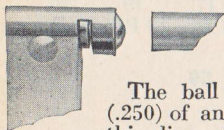


View showing contact of anvil and spindle on wall of tubing.

Packed one in a box.

# Ball Anvil Attachment No. 226

Price, \$1.00



This attachment is easily applied and equips the micrometer to accurately measure tubing and other rounding surfaces.

The ball measures two hundred and fifty thousandths (.250) of an inch in diameter, so when using the attachment this dimension is subtracted from the actual caliper reading.

The ball is free to move in the retainer, thus insuring contact between the ball and the anvil.

The attachment fits the following micrometers: Nos. 8, 8 RS, 10, 10 RS, 19, 19 RS, 20, 20 RS, 25, 26, 38, 38 RS, 47, 47 RS, 48, 48 RS, 50, 50 RS, 51, 51 RS, 52, 52 RS, 53, 53 RS, 245, 246, and 248.

Packed twelve in a box.

## Paper Gauge Micrometer Caliper No. 230

**ENGLISH MEASURE**

or

**METRIC MEASURE**

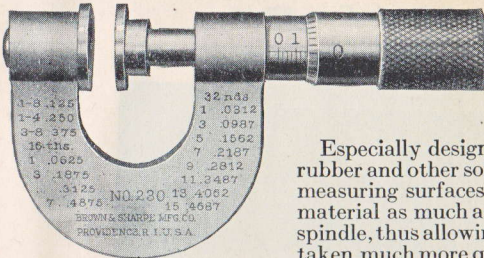
Range, 0 to 3-8"

Range, 0 to 9 m/m

by thousandths of an inch

by hundredths of a millimetre

**Price, \$9.50; With Ratchet Stop, \$10.00; Leather Case, \$1.20**



**With or Without  
Ratchet Stop**

Especially designed for gauging paper, rubber and other soft materials. The large measuring surfaces do not compress the material as much as the regular anvil and spindle, thus allowing measurements to be taken much more quickly and accurately.

Table of decimal equivalents omitted on Metric Micrometer.

## Paper Gauge Micrometer Caliper No. 232

**ENGLISH MEASURE**

or

**METRIC MEASURE**

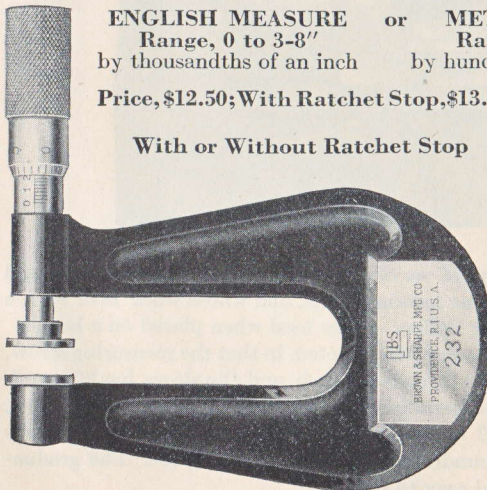
Range, 0 to 3-8"

Range, 0 to 9 m/m

by thousandths of an inch

by hundredths of a millimetre

**Price, \$12.50; With Ratchet Stop, \$13.00; Leather Case, \$2.50**



**With or Without Ratchet Stop**

Especially designed for gauging paper, rubber, and other soft materials. The large measuring surfaces do not compress the material as much as the regular anvil and spindle, thus allowing measurements to be taken much more quickly and accurately. The deep opening in the frame makes it possible to take measurements 2" from the edge of the work.

Each of the above packed one in a box.



## Micrometer Caliper No. 233

**ENGLISH MEASURE**

or

**METRIC MEASURE**

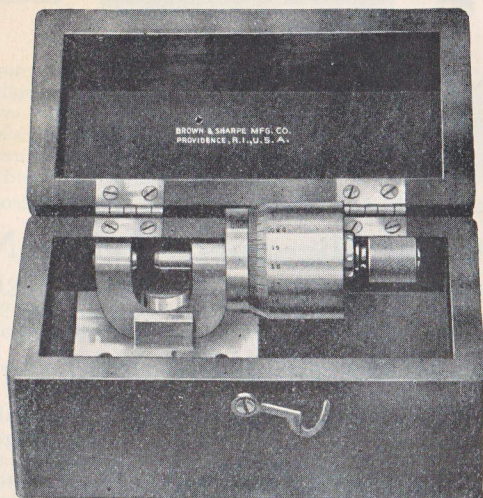
**Range, 0 to 1-2"**

**Range, 0 to 13 m/m**

by ten-thousandths of an inch    by four-hundredths of a millimetre

**Price, in Case, \$30.00**

**Has Ratchet Stop**



**T**HIS caliper is found of service to wire drawers, watchmakers, and others who desire fine measurements, and whose work is of such a class that a Micrometer Caliper can be used when placed on a bench.

It differs from our regular Micrometers in that the measuring screw, English Measure, has 50 threads per inch, and the sleeve has 200 graduations, reading ten-thousandths of an inch direct. The measuring screw, Metric Measure, is 1-2 millimetre pitch and the sleeve has 200 graduations reading four-hundredths of a millimetre direct. The graduations are clean cut and easy to read.

Packed one in a box.



# Micrometer Caliper No. 237

## Rolling Mill Gauge

**ENGLISH MEASURE**

or

**METRIC MEASURE**

Range, 0 to 1"

Range, 0 to 25 m/m

by thousandths of an inch

by hundredths of a millimetre

Price, \$12.50; With Ratchet Stop, \$13.00; Leather Case, \$2.50



**With or Without Ratchet  
Stop**

Especially designed for gauging sheet metal but has a wide range of uses where a caliper with a frame of unusual depth is required.

With this caliper it is possible to take measurements 3" in from the edge of the work.

For table of weights and thickness of Iron and Steel sheets, see pages 232 and 233.

Packed one in a box.

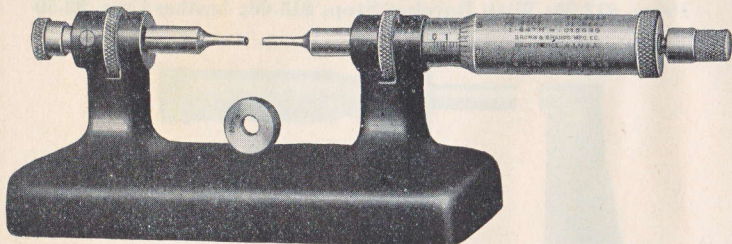
## Bench Micrometer Caliper No. 243

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

**Price, \$12.00**



**Has Clamp Ring and Ratchet Stop**

The bench Micrometer Caliper is particularly useful for taking quick, accurate measurements on work at the bench. Watchmakers, inspectors, manufacturing jewelers, etc., will appreciate its accurate handiness in taking fine measurements. The base is very rigid and of heavy construction which prevents the tool from being upset.

A Clamp Ring is provided for clamping the spindle and preserving the setting so that a series of uniform measurements can be taken on such pieces as are made on Screw Machines, etc. Note that a Clamp Ring is also provided for locking the anvil in position.

For all measurements from 0 to 1-2'' or 0 to 13 m/m the tool is used as shown in the cut. When the anvil is drawn out measurements from 1-2'' to 1'' or 13 m/m to 25 m/m can be taken. The measuring points are 5-64'' (.078'') or 2 1-2 m/m in diameter and are particularly useful when small pieces are to be measured.

A standard is furnished for adjusting the Micrometer.

Table of decimal equivalents omitted on Metric Micrometer.

Packed one in a box.

## Micrometer Caliper No. 245

### ENGLISH MEASURE

or

### METRIC MEASURE

Range, 0 to 6" Length

Range, 0 to 150 m/m Length

0 to 4" Diameter

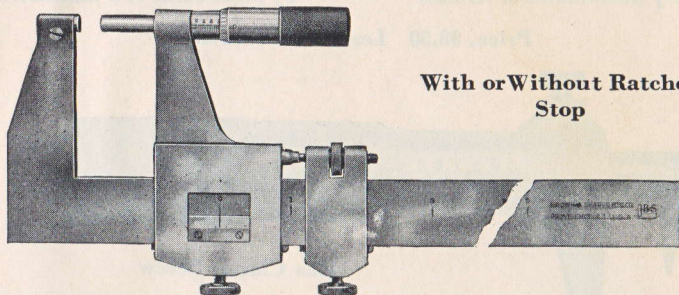
0 to 100 m/m Diameter

by thousandths of an inch

by hundredths of a millimetre

Price, \$52.50; With Ratchet Stop, \$53.00

Price includes finished wooden case.



With or Without Ratchet  
Stop

The micrometer screw is held in a jaw which slides along a bar accurately graduated in inches or every 25 m/m.

## Micrometer Caliper No. 246

With or Without Ratchet Stop

### ENGLISH MEASURE

or

### METRIC MEASURE

Range, 0 to 12" Length

Range, 0 to 300 m/m Length

0 to 6" Diameter

0 to 150 m/m Diameter

by thousandths of an inch

by hundredths of a millimetre

Price, \$59.00; With Ratchet Stop, \$59.50

Price includes finished wooden case.

Similar in design to No. 245 but has greater capacity.

## Micrometer Caliper No. 248

With or Without Ratchet Stop

### ENGLISH MEASURE

or

### METRIC MEASURE

Range, 0 to 24" Length

Range, 0 to 600 m/m Length

0 to 6" Diameter

0 to 150 m/m Diameter

by thousandths of an inch

by hundredths of a millimetre

Price, \$76.00; With Ratchet Stop, \$76.50

Price includes finished wooden case.

Similar in design to No. 245 but has greater capacity.

Each of the above packed one in a box.



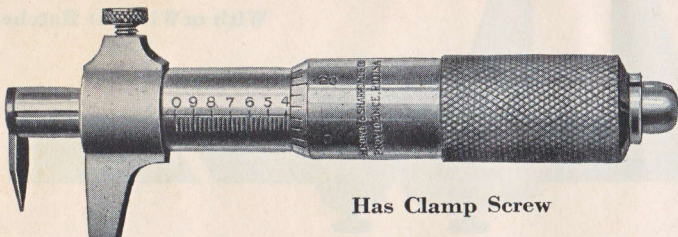
# Depth of Gear Tooth Micrometer No. 249

**ENGLISH MEASURE**  
Range, 0 to 1"  
by thousandths of an inch

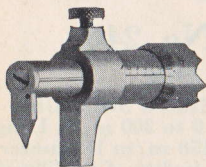
or

**METRIC MEASURE**  
Range, 0 to 25 m/m  
by hundredths of a millimetre

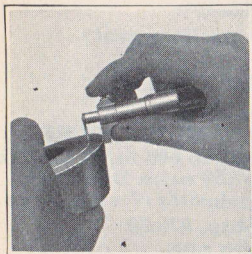
Price, \$8.50 Leather Case, \$1.25



Has Clamp Screw



Designed for scribing a line on gear blanks and particularly on bevel gear blanks, to accurately indicate the extreme depth to cut the teeth. For this purpose it is a particularly economical tool, in that it does away with the necessity of keeping a large number of separate gauges for the different pitches.



Toolmakers will also find it handy as a scratch gauge in scribing lines and measuring spacing within its range. The scriber point is hardened.

**Extra scriber points. Price, 40 cents each.**

Packed one in a box.

# Inside Micrometer Caliper No. 250

## ENGLISH MEASURE

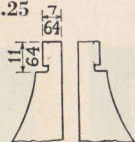
Range, .200" to 1"  
by thousandths of an inch

or

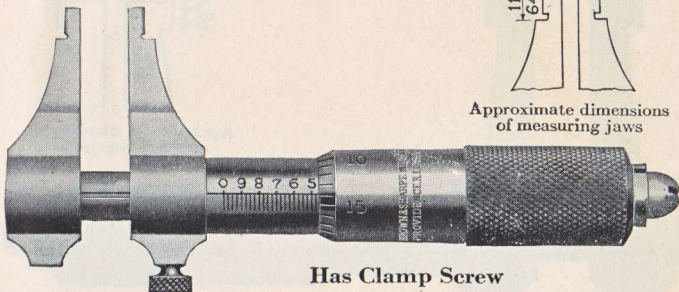
## METRIC MEASURE

Range, 5 m/m to 25 m/m  
by hundredths of a millimetre

Price, \$14.00 Leather Case, \$1.25



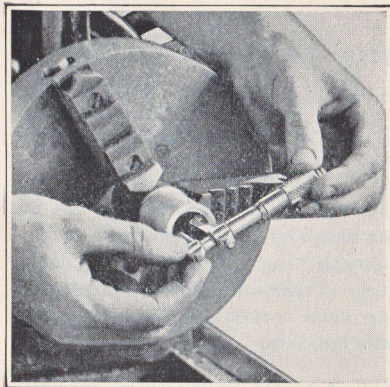
Approximate dimensions  
of measuring jaws



Has Clamp Screw

Meets the demand for a tool adapted to measure small internal dimensions. The measuring screw is entirely enclosed, thus protecting it from dirt and injury. The measuring surfaces are hardened and ground to a radius to insure accurate measurements and prevent cramping when measuring parallel surfaces.

The cut opposite shows how handy this type of inside micrometer is to use and how easily the graduations can be read when in use. For measuring internal diameters over a flange or shoulder, as shown in the cut, Inside Micrometers Nos. 252 and 254 are particularly useful because of the shape of the measuring jaws.



Packed one in a box.

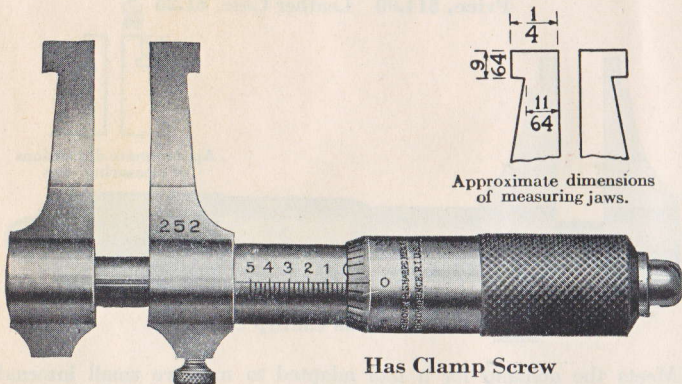
## Inside Micrometer Caliper No. 252

**ENGLISH MEASURE**  
Range, 1-2" to 1 1-2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 12 m/m to 37 m/m  
by hundredths of a millimetre

Price, \$15.00 Leather Case, \$1.25



Has Clamp Screw

The shape of the jaws of this tool enables the user to take inside measurements over a flange or shoulder. Note dimensions of jaws above.

## Inside Micrometer Caliper No. 254

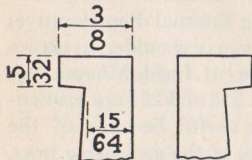
**ENGLISH MEASURE**  
Range, 1" to 2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 25 m/m to 50 m/m  
by hundredths of a millimetre

Price, \$15.00 Leather Case, \$1.60

Has Clamp Screw



Approximate dimensions  
of measuring jaws.

This tool is similar in design to No. 252 shown above but the length of spindle gives it a greater range. The wide jaws enable the user to take inside measurements over a deep flange or shoulder. Note dimensions of jaws opposite.

Each of the above packed one in a box.



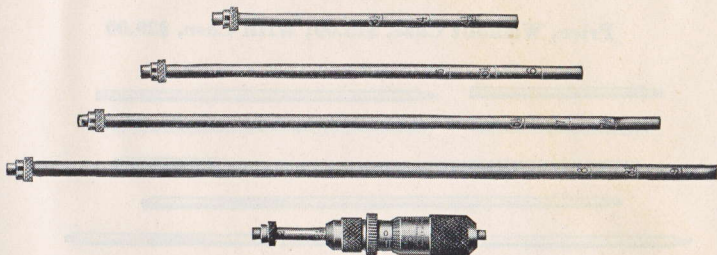
## Inside Micrometer No. 260

**ENGLISH MEASURE**  
Range, 2" to 9 1-2"  
by thousandths of an inch  
Has 5 Measuring Rods

or

**METRIC MEASURE**  
Range, 50 m/m to 230 m/m  
by hundredths of a millimetre  
Has 6 Measuring Rods

**Price, Without case, \$9.00; With case, \$10.75**



Consists of a holder with a micrometer screw and thimble, and extension rods that are graduated by a series of angular grooves of a form and depth that allow the clamping fingers to spring in and the adjustment to be quickly and positively made. The micrometer screw has 1-2" movement.

(Attachment No. 598 is very useful in connection with this micrometer, making it a handy and accurate micrometer height gauge.)

## Inside Micrometer No. 261

**ENGLISH MEASURE**  
Range, 2" to 12 1-2"  
by thousandths of an inch  
Has 7 Measuring Rods

or

**METRIC MEASURE**  
Range, 50 m/m to 290 m/m  
by hundredths of a millimetre  
Has 8 Measuring Rods

**Price, Without case, \$10.50; With case, \$13.25**

Similar to No. 260 except in the number of measuring rods and consists of a holder with a micrometer screw and thimble, and extension rods that are graduated by a series of angular grooves of a form and depth that allow the clamping fingers to spring in and the adjustment to be quickly and positively made. The micrometer screw has 1-2" movement.

(Attachment No. 598 is very useful in connection with this micrometer, making it a handy and accurate micrometer height gauge.)

Each of the above packed one in a box.

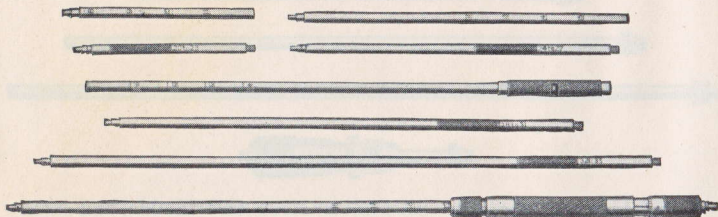
## Inside Micrometer No. 262

**ENGLISH MEASURE**  
Range, 8" to 36"  
by thousandths of an inch  
Has 8 Measuring Rods

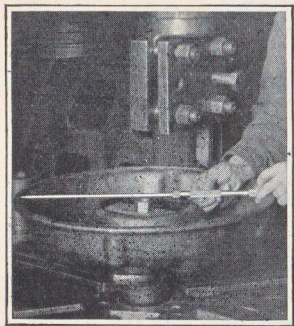
or

**METRIC MEASURE**  
Range, 200 m/m to 900 m/m  
by hundredths of a millimetre  
Has 8 Measuring Rods

**Price, Without Case, \$15.00; With Case, \$20.00**



Consists of a holder with a Micrometer screw and thimble and extension rods that are graduated by a series of angular grooves of a form and depth that allow the clamping fingers to spring in and the adjustments to be quickly and positively made. The Micrometer screw has 1" movement. For convenience in attaching the rods knurled finger grips are provided.



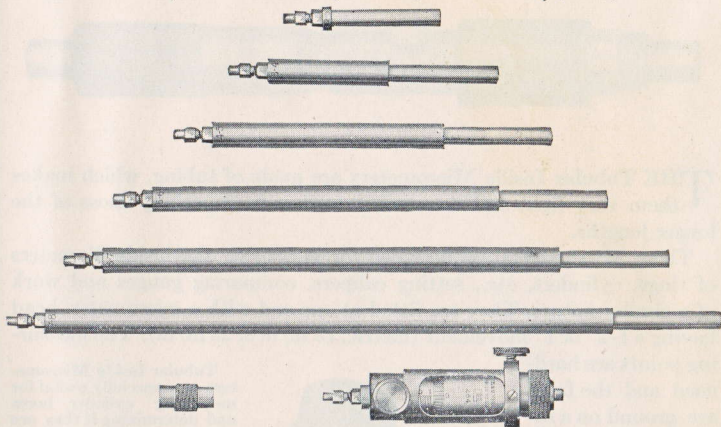
This style of micrometer is well adapted for use wherever it is desired to measure the inside diameters of rings, cylinders, and similar work of comparatively large size. It is especially useful where a big range of measurements is required. The adjustments are easily and quickly made.

Packed one in a box.

## Inside Micrometer No. 264

Range, 2" to 8"  
by thousandths of an inch  
Has 6 Measuring Rods

Price, Without Case, \$10.00; With Case, \$11.75



This tool is particularly adapted for all ordinary motor service requirements for measuring cylinder bores, rings, and any other inside measuring jobs. It consists of a holder with a 1-2 inch micrometer screw and extension rods.

The holder of this tool has a clamping device which clamps the thimble and thus prevents the screw from turning when in use.

The collar which is provided, slips over the end of the rod and can be set accurately against the micrometer head. In order to obtain the full one-inch range with each rod, the spacing collar must be added.

Each rod has a shoulder one inch from the end which fits against the micrometer head. When the rod is in position with shoulder against the head, the first half of the inch can be measured (example, 3" to 3 1-2"). When the spacing collar is in place on the rod the last half of the inch can be measured (example 3 1-2" to 4").

The measuring ends of the rods are hardened and so designed that it is possible to adjust or compensate for wear by loosening the lock nut and turning the screw with the hardened head one way or the other as desired.



Inside Micrometer Handle No. 287 is very useful in connection with this micrometer.

Packed one in a box.



## Tubular Inside Micrometers Nos. 270 and 272

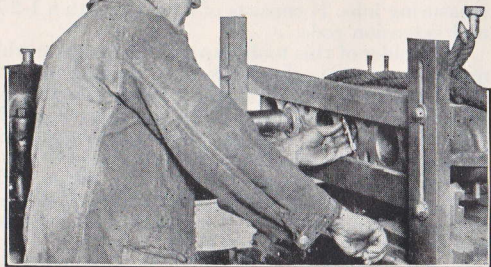


**T**HE Tubular Inside Micrometers are made of tubing, which makes them very light and convenient to handle, especially those of the longer lengths.

These Micrometers are designed for measuring the inside diameters of rings, cylinders, etc., setting calipers, comparing gauges and work of a similar nature. They are fitted at one end with a micrometer head having a 1-2" or 1" movement (metric, 13 m/m or 25 m/m). The measuring points are hardened and the faces are ground on a radius, thus adapting them especially for measuring parallel or curved surfaces.

Fibre grips are provided to guard against inaccuracies due to the heat of the hand. The small sizes have one grip, while the larger sizes have two.

Tubular Inside Micrometers are especially useful for measuring cylinder bores and determining if they are out of round. They insure a close, uniform fit between the piston and cylinder.



Each tool is provided with a clamp screw which clamps the spindle and preserves the setting.



Inside Micrometer Handle No. 287 is very useful in connection with this micrometer.

# Tubular Inside Micrometers No. 270

## ENGLISH MEASURE

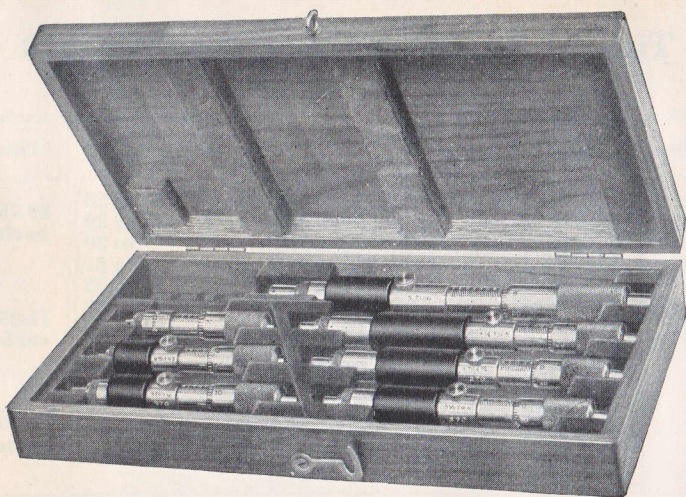
No.	Range, Inches	Price	Range, Inches	Price	Range, Inches	Price
270	2 to 2 1-2	\$6.00 each	13 to 14	\$7.00 each	27 to 28	\$9.75 each
	2 1-2 to 3		14 to 15		28 to 29	
	3 to 3 1-2		15 to 16	7.50 each	29 to 30	
	3 1-2 to 4		16 to 17		30 to 31	11.25 each
	4 to 4 1-2		17 to 18		31 to 32	
	4 1-2 to 5	6.50 each	18 to 19		32 to 33	
	5 to 6		19 to 20		33 to 34	
	6 to 7		20 to 21		34 to 35	
	7 to 8		21 to 22	8.25 each	35 to 36	13.00 each
	8 to 9	7.00 each	22 to 23		36 to 37	
	9 to 10		23 to 24		37 to 38	
	10 to 11		24 to 25		38 to 39	
	11 to 12		25 to 26		39 to 40	
	12 to 13		26 to 27			

# Tubular Inside Micrometers No. 272

## METRIC MEASURE

No.	Range, Millimetres	Price	Range, Millimetres	Price	Range, Millimetres	Price
272	50 to 63	\$6.00 each	325 to 350	\$7.00 each	675 to 700	\$9.75 each
	63 to 75		350 to 375		700 to 725	
	75 to 88		375 to 400	7.50 each	725 to 750	
	88 to 100		400 to 425		750 to 775	11.25 each
	100 to 113	6.50 each	425 to 450		775 to 800	
	113 to 125		450 to 475		800 to 825	
	125 to 150		475 to 500		825 to 850	
	150 to 175		500 to 525	8.25 each	850 to 875	13.00 each
	175 to 200		525 to 550		875 to 900	
	200 to 225		550 to 575		900 to 925	
	225 to 250	7.00 each	575 to 600		925 to 950	
	250 to 275		600 to 625		950 to 975	
	275 to 300		625 to 650		975 to 1000	
	300 to 325		650 to 675			

Each of the above packed one in a box.



## Tubular Inside Micrometer Set No. 273

7 Micrometers

**ENGLISH MEASURE**  
Range, 2" to 6"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 50 m/m to 150 m/m  
by hundredths of a millimetre

**Price, in finished wooden case, \$45.50**

Consists of Tubular Inside Micrometers Nos. 270 or 272

## Tubular Inside Micrometer Set No. 274

13 Micrometers

**ENGLISH MEASURE**  
Range, 2" to 12"  
by thousandths of an inch

or

**METRIC MEASURE**  
Range, 50 m/m to 300 m/m  
by hundredths of a millimetre

**Price, in finished wooden case, \$88.50**

Consists of Tubular Inside Micrometers Nos. 270 or 272

Each of the above packed one set in a box.



## Tubular Inside Micrometer Set No. 285

41 Micrometers

**ENGLISH MEASURE**

Range, 2" to 40"  
by thousandths of an inch

or

**METRIC MEASURE**

Range, 50 m/m to 1000 m/m  
by hundredths of a millimetre

Price, in finished wooden case, \$345.75

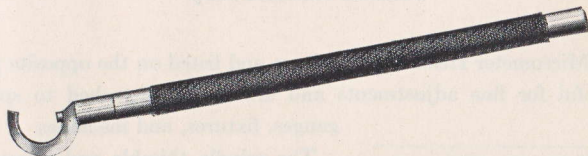
Consists of Tubular Inside Micrometers, No. 270 or 272

Packed one set in a box.

## Inside Micrometer Handle No. 287

For Micrometers Nos. 264 and 270

Price, \$1.00



When measuring the diameters of small holes it is often difficult to hold the micrometer and get accurate measurements. With this handle the No. 264 Inside Micrometer and small sizes from 2" to 5" of the No. 270 Tubular Inside Micrometers are made more convenient to use as they can be inserted in small holes for a greater distance than by the hand alone.

The hooked end of the handle fits snugly around the body of the micrometer and the brass plug which is forced against the micrometer clamps the handle tight without marring the tool. By simply turning the handle it is tightly locked in position and ready for use.

Packed one in a box.

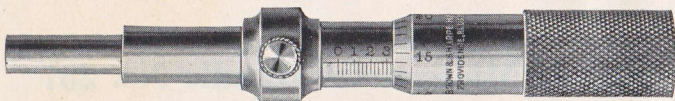
## Micrometer Heads

### Nos. 290, 291, 294 and 295



#### 1-2" Micrometer Head

Furnished with or without Ratchet Stop



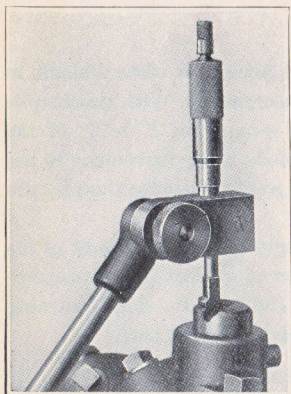
#### 1" Micrometer Head

Furnished with or without Clamp Screw and with or without Ratchet Stop

The Micrometer Heads shown above and listed on the opposite page are useful for fine adjustments and are readily attached to special gauges, fixtures, and machines.

The spindle, thimble, and measuring screw of these heads are of the same construction as in the regular micrometers. These heads bring micrometer accuracy where it might be otherwise difficult to get it.

The illustration shows a one-inch head being used to accurately set a tool in a screw machine turret. It is held by a split clamp which is attached to the arm of a dial indicator, the base of which is attached to the machine.



## 1-2" Micrometer Head No. 290

<b>ENGLISH MEASURE</b>	<b>or</b>	<b>METRIC MEASURE</b>
Measures by thousandths of an inch		Measures by hundredths of a millimetre
Length from lower end of barrel to shoulder, 3-8" or 9 m/m.		
Diameter of barrel, 3-8" or 9 m/m.		

**Price, with or without Ratchet Stop, \$4.50**

Furnished without Ratchet Stop unless otherwise ordered.

## 1-2" Micrometer Head No. 291

Measures by **ten-thousandths**  
as well as thousandths of an inch

Length from lower end of barrel to shoulder, 3-8" or 9 m/m.  
Diameter of barrel, 3-8" or 9 m/m.

**Price, with or without Ratchet Stop, \$6.25**

Furnished without Ratchet Stop unless otherwise ordered.

## 1" Micrometer Head No. 294

<b>ENGLISH MEASURE</b>	<b>or</b>	<b>METRIC MEASURE</b>
Measures by thousandths of an inch		Measures by hundredths of a millimetre
Length from lower end of barrel to shoulder, 3-4" or 21 m/m.		
Diameter of barrel 3-8" or 9 m/m.		

**Price, with or without Ratchet Stop and with or without  
Clamp Screw, \$5.50**

Furnished without Ratchet Stop and Clamp Screw unless otherwise ordered.

## 1" Micrometer Head No. 295

Measures by **ten-thousandths**  
as well as thousandths of an inch

Length from lower end of barrel to shoulder, 3-4" or 21 m/m.  
Diameter of barrel, 3-8" or 9 m/m.

**Price, with or without Ratchet Stop and with or without  
Clamp Screw, \$7.25**

Furnished without Ratchet Stop and Clamp Screw unless otherwise ordered.

Each of the above packed one in a box.



## Standards of Length

**T**HE Standard Yard was first legalized in England in 1824; this Standard, however, was destroyed in 1834. The Standard Imperial Yard, "Bronze No. 1," was then prepared and legalized in 1855. Forty copies were made and one of these, "Bronze No. 11," was presented to the United States by the British Government in 1856. At the same time another copy, known as "Low Moor Iron No. 57," was sent. These were accurately compared with the Standard Imperial Yard before being sent, and the record of the variations sent with them.

The use of the Metre as a Standard in this country was legalized in 1866 and prototypes of the original Metre Bar were prepared in 1899; one of these, which was sent to Washington, is now being used as the basis of "Metric Measurements" in this country.

We prepared Standards for use in our own shops, and after their completion, they were compared by the Government officials with the Standards in Washington.

The mean errors were found to be for the Yard, .00002", and for the metre, .000005M., both being too long.

These Standards have been subdivided with the greatest care and accuracy, and our Rules are as nearly exact copies as expert mechanical skill, aided by machines especially designed for the purpose, can make them.

It is interesting to note that the Brown & Sharpe Mfg. Co. were among the first to manufacture steel rules in this country and were more recently the pioneers in introducing the first rules, as far as is known, to be made of Stainless Steel.

The Brown & Sharpe Mfg. Co. has been influential in advancing the standards of accuracy in linear measurements since 1850 and our complete line of rules includes every style and size that are demanded by the mechanic. They are made of the highest quality steel and graduated with great care and accuracy.

## Graduations

Our Rules are divided into parts of an inch, as follows:

No. 1 Graduation	No. 2 Graduation	No. 4 Graduation
1st corner, 10, 20, 50, 100	8	8
2nd corner, 12, 24, 48	10, 20, 50, 100	16
3rd corner, 14, 28	12, 24, 48	32
4th corner, 16, 32, 64	16, 32, 64	64

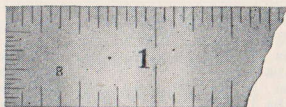
### No. 7 Graduation

16  
32  
64  
100

No. 10 Graduation	No. 11 Graduation	No. 12 Graduation
1st corner, 32	64	50
2nd corner, 64	100	100

**Metric Rules** are graduated to read by half-millimetres, millimetres, or both.

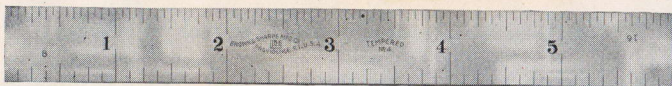
**End**



**Graduations**

Rules Nos. 300, 315, 320, 2'' to 12'' in length, with No. 4 Graduation, are furnished with End Graduations reading to 32nds of an inch on two ends of one side. This feature will be found advantageous in measuring the depth and width of grooves, countersinks and recesses of various kinds.

## Tempered Steel Rules No. 300



These rules are about 1-20th of an inch thick excepting the 48" which is about 1-10th of an inch thick.

No.	Length, Inches	Approx. Width, In.	Number of Graduation	Price	Length, Inches	Approx. Width, In.	Number of Graduation	Price
300	1	29-64	4	\$0.30	12	31-32	1, 2, 4 or 7	\$1.65
	2	1-2	4 or 7	.45	18	1	4 or 7	2.60
	3	35-64	4 or 7	.60	24	1	4 or 7	3.25
	4	19-32	4 or 7	.75	36	1	4 or 7	7.00
	6	11-16	1, 2, 4 or 7	.90	*48	1 1-2	4 or 7	10.00
	9	53-64	4 or 7	1.35				

\*Not tempered.

For Graduation Numbers, see page 75.

## Tempered Steel Rules No. 301

### METRIC MEASURE

These rules are about 1 1-2 m/m thick. First corner graduated in 1-2 m/m and remaining three corners in m/m.

No.	Length, c/m	Approximate Width, m/m	Price	Length, c/m	Approximate Width, m/m	Price
301	10	15	\$0.75	30	24	\$1.65
	15	17	.90	50	25	2.60
	20	21	1.20			

## Tempered Steel Rules No. 302

### ENGLISH AND METRIC MEASURE

These rules are about 1 1-2 m/m or about 1-20th of an inch thick.

No.	Length, c/m	Length of English Graduations, Inches	Approximate Width	Graduations	Price
302	10	{ 3 7-8 in 64ths } { 3 9-10 in 100ths }	9-16" or 15 m/m	{ 1st corner: 64ths 2nd corner: m/m 3rd corner: 100ths 4th corner: 1-2 m/m }	\$0.75
	15	{ 5 7-8 in 64ths } { 5 8-10 in 100ths }	11-16" or 17 m/m		.90
	20	{ 7 3-4 in 64ths } { 7 8-10 in 100ths }	3-4" or 21 m/m	{ 1st cor: in 64ths for 2", 16ths for remainder of length. 2nd corner: in m/m. 3rd cor: 100ths for 2", 50ths for remainder of length. 4th cor: in 1-2 m/m. }	1.20
	30	{ 11 5-8 in 64ths } { 11 7-10 in 100ths }	15-16" or 24 m/m		1.65
	50	{ 19 1-2 in 64ths } { 19 6-10 in 100ths }	1" or 25 m/m		2.60

Each of the above packed six in a box, except 18" to 48" (and 50 c/m) which are packed one in a package.



## Narrow Tempered Steel Rules No. 303



These rules are about 1-20th of an inch thick and about 7-32nds of an inch wide. Graduated on one corner of each side only.

No.	Length, Inches	Number of Graduation	Price
303	4	10 or 11	\$0.75
	6	10 or 11	.90
	9	10 or 11	1.35
	12	10 or 11	1.65

For Graduation Numbers, see page 75.

## Narrow Tempered Steel Rules No. 304

### METRIC MEASURE

These rules are about 1 1-2 m/m thick and about 5 1-2 m/m wide. Graduated on one corner of each side only.

No.	Length, Centimetres	Graduations	Price
304	10	1st corner: 1-2 m/m 2nd corner: m/m	\$0.75
	15		.90
	20		1.20
	30		1.65

## Narrow Tempered Steel Rules No. 305

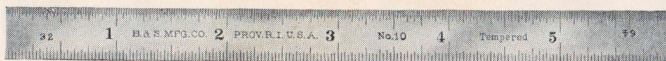
### ENGLISH AND METRIC MEASURE

These rules are about 1-20 of an inch thick and 7-32 of an inch wide or about 1 1-2 m/m thick and 5 1-2 m/m wide. Graduated on one corner of each side only.

No.	Length, Centimetres	Length of English Graduations, Inches	Graduations	Price
305	10	3 7-8 in 64ths	1st corner: 64ths 2nd corner: 1-2 m/m	\$0.75
	15	5 7-8 in 64ths		.90
	20	7 13-16 in 64ths		1.20
	30	11 3-4 in 64ths		1.65

Each of the above packed six in a box.

## Flexible Steel Rules No. 306



These rules are tempered and very springy, being about .017 of an inch thick. Graduated on both corners of one side only. The 4" and 6" sizes are furnished in leather cases.

No.	Length, Inches	Approximate Width, Inches	Number of Graduation	Price
306	4	1-2	10	\$0.75
	6	1-2	10, 11 or 12	.90
	9	1-2	10	1.35
	12	1-2	10, 11 or 12	1.65
	18	3-4	10	2.60
	24	3-4	10	3.25

For Graduation Numbers, see page 75.

## Flexible Steel Rules No. 307

### METRIC MEASURE

These rules are about 1-2 m/m thick and about 13 m/m wide. Graduated on both corners of one side only. The 10 c/m and 15 c/m sizes are furnished in leather cases.

No.	Length, Centimetres	Graduations	Price
307	10	1st corner: 1-2 m/m 2nd corner: m/m	\$0.75
	15		.90
	30		1.65

## Flexible Steel Rules No. 308

### ENGLISH AND METRIC MEASURE

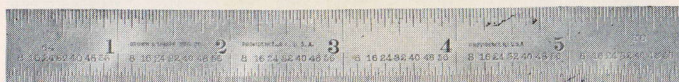
These rules are about .017 of an inch thick and 1-2 of an inch wide or about 1-2 m/m thick and about 13 m/m wide. Graduated on both corners of one side only. The 10 c/m and 15 c/m sizes are furnished in leather cases.

No.	Length, Centimetres	Length of English Graduations, Inches	Graduations	Price
308	10	3 7-8 in 64ths	1st corner: 64ths 2nd corner: 1-2 m/m	\$0.75
	15	5 3-4 in 64ths		.90
	30	11 3-4 in 64ths		1.65

Each of the above packed six in a box, except 18" and 24" which are packed one in a package.

## Tempered Steel Rules No. 315

### With Figured Graduations

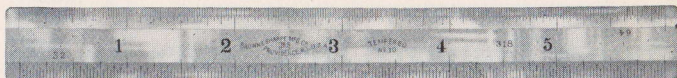


The 64th graduations are numbered every 8th graduation line, as 8, 16, 24, etc. These rules are about 1-20th of an inch thick.

No.	Length, Inches	Approximate Width, Inches	Number of Graduation	Price
315	1	29-64	4	\$0.30
	2	1-2	4	.45
	3	35-64	4	.60
	4	19-32	4	.75
	6	11-16	4	.90
	9	53-64	4	1.35
	12	31-32	4	1.65
	18	1	4	2.60
	24	1	4	3.25

## Tempered Steel Rules No. 318

### With Beveled Edges



Beveled on both edges of one side. Graduated on the beveled edges only. They are about 1-16th of an inch thick.

Rules from 1" to 6", inclusive, are furnished in leather cases.

No.	Length, Inches	Approximate Width, Inches	Number of Graduation	Price
318	1	5-8	10 or 11	\$0.50
	2	5-8	10 or 11	.65
	3	5-8	10 or 11	.85
	4	5-8	10 or 11	1.00
	6	11-16	10 or 11	1.20
	9	53-64	10 or 11	1.50
	12	1	10 or 11	1.80
	18	1	10 or 11	3.90
	24	1	10 or 11	4.80

For Graduation Numbers, see Page 75.

Each of the above packed six in a box, except 18" and 24" which are packed one in a package.



## Tempered Hook Rules No. 320

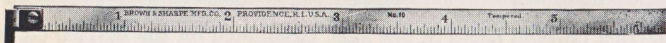


These are tempered rules with a hook attached and are very convenient in taking measurements of flanges or circular pieces or through the hubs of pulleys; also for setting calipers and dividers and taking measurements from points where the user cannot see if the rule is even with the measuring edge. When it is desired the hook may be quickly detached and the rule used as an ordinary steel rule.

They have No. 4 graduation and the 4" to 12" sizes are furnished with end graduations. The thickness of these rules is about 1-20th of an inch.

No.	Length, Inches	Approximate Width, Inches	Price
320	4	19-32	\$1.10
	6	11-16	1.25
	9	53-64	1.75
	12	31-32	2.15
	18	1	3.10
	24	1	3.75
	36	1	7.65

## Narrow Tempered Hook Rules No. 325



These rules are narrow and enable the user to take measurements through holes as small as 3-8" in diameter. Graduated on one corner of each side only with No. 10 graduation. They are about 1-20th of an inch thick.

No.	Length, Inches	Approximate Width, Inches	Price
325	4	7-32	\$1.00
	6	7-32	1.20
	9	7-32	1.65
	12	7-32	2.00

For Graduation Numbers, see Page 75.

Hook rules are furnished with metric graduations when ordered. Prices as listed above.

Packed six in a box, except 18", 24", and 36", which are packed one in a package.

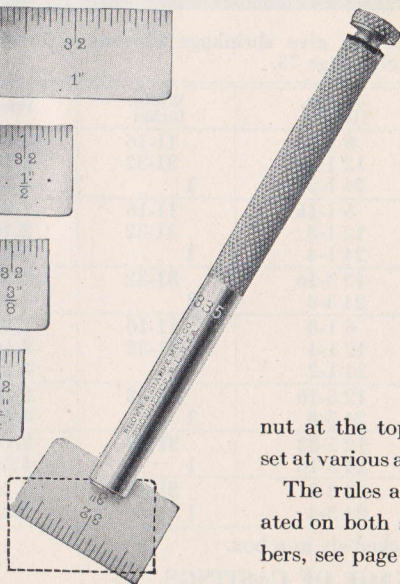
## Steel Rules with Holder No. 335

ENGLISH MEASURE or METRIC MEASURE

Lengths, 1-4, 3-8, 1-2, 3-4, and 1" Lengths, 5, 10, 15, 20, and 25 m/m

5 Rules Interchangeable in One Holder

Price, complete, \$2.50



The rules and holder are convenient where the ordinary rule cannot be used as in measuring a recess or keyway as well as the general class of tool and die work.

The holder has a knurled finger grip and takes either of the five sizes of rules. They are held in a split chuck adjusted by a knurled nut at the top of the barrel and can be set at various angles according to the work.

The rules are of tempered steel, graduated on both sides. For graduation numbers, see page 75.

### Rules for No. 335

English		Metric		Price of Rules
Length, Inches	Number of Graduation	Length, m/m	Metric Graduations	
1-4	10	5	} m/m and 1-2 m/m }	\$0.35
3-8	10	10		.35
1-2	10 or 12	15		.35
3-4	10	20		.35
1	10 or 12	25		.35

Holder, Price, \$0.75

Packed one in a box.

## Tempered Steel Shrink Rules

### Nos. 340, 341, 342, 343, 344, 345 and 346



Shrink rules are graduated to give shrinkage allowances directly, and have No. 4 graduation. See page 75.

No.	Shrink per Foot	Length, Inches	Width, Inches	Price
340	1-10	6 1-20	11-16	\$1.00
	1-10	12 1-10	31-32	2.10
	1-10	24 1-5	1	4.25
341	1-8	6 1-16	11-16	1.00
	1-8	12 1-8	31-32	2.10
	1-8	24 1-4	1	4.25
342	3-16	12 3-16	31-32	2.10
	3-16	24 3-8	1	4.25
343	1-4	6 1-8	11-16	1.00
	1-4	12 1-4	31-32	2.10
	1-4	24 1-2	1	4.25
344	5-16	12 5-16	31-32	2.10
	5-16	24 5-8	1	4.25
345	5-32	12 5-32	31-32	2.10
	5-32	24 5-16	1	4.25
346	3-8	12 3-8	31-32	2.10
	3-8	24 3-4	1	4.25

Packed six in a box.

### SHRINKAGE OF CASTINGS

The allowance necessary for shrinkage varies for different kinds of metal, and the different conditions under which they are cast. For castings where the thickness runs fairly uniform, cast under ordinary conditions, the following allowance can be made:

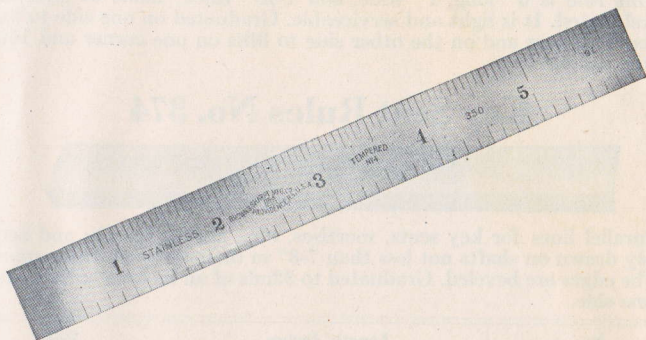
For Cast Iron,	1-8" per ft.	For Zinc,	5-16" per ft.
" Brass,	3-16" " "	" Tin,	1-12" " "
" Steel,	1-4" " "	" Aluminum,	3-16" " "
" Malleable Iron,	1-8" " "	" Britannia,	1-32" " "

The above table gives the standard shrinkage of different metals, but some consideration must be given to the size and shape of the casting. Thick castings will shrink less, under the same conditions, and thinner ones more, than the standard. The quality of the material and the manner of molding and cooling will also make a difference in shrinkages.



## Stainless Steel Rules No. 350

### Tempered



These rules are rustproof, will not stain or discolor, but will always retain their bright finish.

Those who use a rule constantly will find that a Stainless Steel Rule does not grow dull or become blackened, even after it has been used a long while. Those who use a rule only once in a while can put this Stainless Steel Rule away with the certainty that when there is further use for it, the rule will be bright, shiny and easy to read.

Stainless Steel is a high-grade alloy steel, the stain-resisting properties being produced by the addition of chromium. In order to bring out the stain-resisting properties of Stainless Steel to the utmost, careful hardening and grinding are necessary. The Brown & Sharpe method of hardening and grinding brings out the stain-resisting qualities to the fullest in these rules.

They are tempered and have No. 4 Graduation.

No.	Length, Inches	Width, Inches	Price
350	6	11-16	\$1.35
	12	31-32	2.65

For graduation numbers, see page 75.

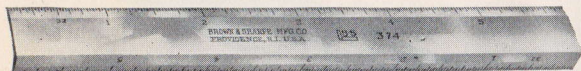
Packed six in a box.

## Work Basket Rule No. 372

Price, \$1.00

This rule is 6" long, 1" wide, and 1-40" thick, made of steel and nickel plated. It is light and serviceable. Graduated on one side to 8ths on both corners and on the other side to 8ths on one corner and 16ths on the other.

## Key Seat Rules No. 374



Parallel lines for key seats, mortises, etc., can be readily and accurately drawn on shafts not less than 7-8" in diameter with these rules.

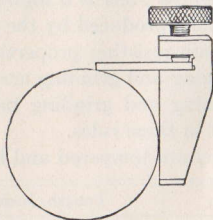
The edges are beveled. Graduated to 32nds of an inch on both corners of one side.

No.	Length, Inches	Price
374	4	\$3.00
	6	3.60
	8	4.50

Each of the above packed six in a box.

## Key Seat Clamps No. 377

Price, 75 cents per pair



These clamps can be attached to steel rules for laying out keyways and scribing parallel lines on circular pieces.

They are easily put on and taken off and can be used on combination square blades and straight edges as well as rules.

Packed one pair in a box, 6 boxes in a carton.

## 6-Inch Rule with Slide No. 380

ENGLISH MEASURE or METRIC MEASURE

Price, \$2.00



The slide enables the user to take a series of accurate measurements against shoulders or flanges. The slide may be used on either side of the rule or may be removed and the rule used alone.

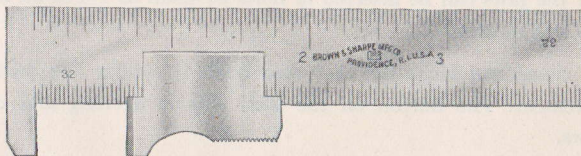
**English Measure** rules are 6" long, 9-16" wide, and 1-16" thick, with No. 4 Graduation. (See Page 75.)

**Metric Measure** rules are 15 c/m long, 15 m/m wide, and 1 1-2 m/m thick. They are graduated on three corners in millimetres and one corner in half millimetres.

## Slide Caliper Rule No. 385

ENGLISH MEASURE or METRIC MEASURE

Price, \$2.50



For measuring small rods, tubing, sheet stock, etc., this tool is very desirable as the slide enables the user to get quick measurements.

**English Measure** rules are 4 3-16" long, 1-16" wide, and about 1-16" thick, graduated on both corners in 32ds of an inch. The jaws are about 3-8" deep.

**Metric Measure** rules are 10 c/m long, 17 m/m wide, and 1 1-2 m/m thick. They are graduated on one side only in half millimetres on both corners. The jaws are about 9 1-2 m/m deep.

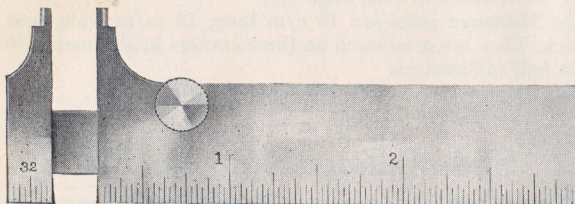
Each of the above packed six in a box.



# Pocket Slide Caliper Rule No. 388

ENGLISH MEASURE or METRIC MEASURE

Price, \$4.00



These rules accurately measure inside and outside diameters. The nibs of the jaws can be inserted in holes as small as 1-8 of an inch or 3 m/m in diameter.

The clamp nut locks the slide and holds it set for any particular measurement. The button on the slide aids in opening and closing the jaws.

**English Measure** rules are 3" long, 11-16" wide, and about 1-8" thick. One corner is graduated in 32nds" and the slide in 64ths" for 2 1-2". The jaws are 5-8" long, and, when open, measure up to 2".

**Metric Measure** rules are 75 m/m long, 17 m/m wide, and about 3 m/m thick. One corner is graduated in m/m and the slide in 1-2 m/m. The jaws are about 15 m/m long and measure up to 50 m/m.

Packed six in a box.

## Steel Caliper Rule No. 391

### ENGLISH MEASURE or METRIC MEASURE



Convenient for use in the stock room, in selecting sheet or bar stock, wire tubing, etc.

**English Measure.** The slide of the 3" rule can be drawn out to measure 2 1/4", and the slide of the 4" to measure 3 1/4".

**Metric Measure.** The slide of the 75 m/m rule can be drawn out to measure 50 m/m, and the slide of the 100 m/m to measure 75 m/m.

No.	Length, English	Length, Metric	Graduations			Price
			Corner	C	Metric	
391	3"	75 m/m	1st	8	8	\$5.00
			2nd	16	16	
	4"	100 m/m	3rd	32	32	5.50
			4th	64	64	
			slide	32-64	64-100	

In ordering state whether style C or D graduation is desired.  
These Rules can be furnished nickel plated when desired. Prices on application.

## Button Rule No. 397

Price, \$5.00

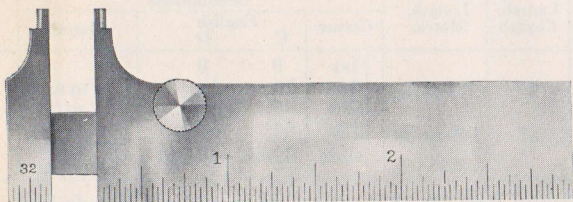
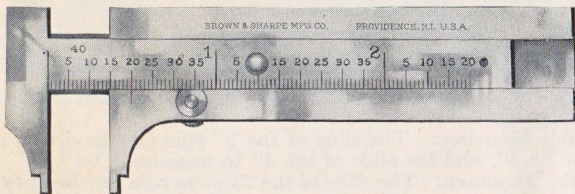


The length of this rule is 3". First corner is graduated in 16ths, second corner in 20ths, third corner in 32nds, fourth corner in 40ths of an inch, and the slide in 40ths and 80ths of an inch.

Each of the above packed six in a box.

## Pocket Button Rule No. 398

Price, \$4.00



This Pocket Slide Caliper Rule or Button Rule is exceptionally convenient to use and will fit easily into the pocket when not in use.

On one side it is graduated in 32nds of an inch and can be used as an ordinary rule. On the other side it is used as a button rule, the graduations on the slide reading to 40ths of an inch. It has a range of 2" and both external and internal measurements can be made. The button on the slide aids in opening and closing the jaws.

When the slide is set for any particular measurement it can be securely clamped in position by a Clamp Nut.

Packed six in a box.



# Combination Squares, Combination Sets, and Protractors Nos. 400 to 461

**B**ROWN & SHARPE Combination Squares and Sets are accurately made and adaptable to a great many uses. The unhardened heads are of cast iron. The hardened heads are drop forged and are light, durable, and convenient.

The revolving turrets in the protractors are accurately fitted and graduated to 90 degrees either side of zero. They can be set accurately at any angle and rigidly clamped by a thumb nut.

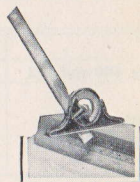
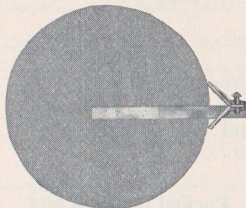
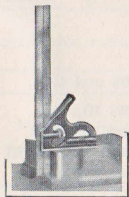
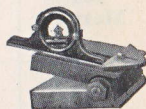
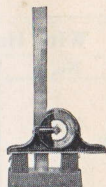
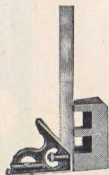
The round clamping groove allows the blades to be quickly inserted in the heads. The clamping bolt forces the blade against the side of the slot square with the face of the head and presents no sharp corners to collect dirt and interfere with the accuracy of the tool.

The levels which are furnished with all but the four-inch sets, are accurately set and fastened to the side of the turret and in a protected position on the square head.

The square heads have wide surfaces and, together with the blade, make excellent try squares. With the blade the square head can be used as a depth or height gauge. The accuracy of the 45-degree angle can be relied on—it is made correctly.

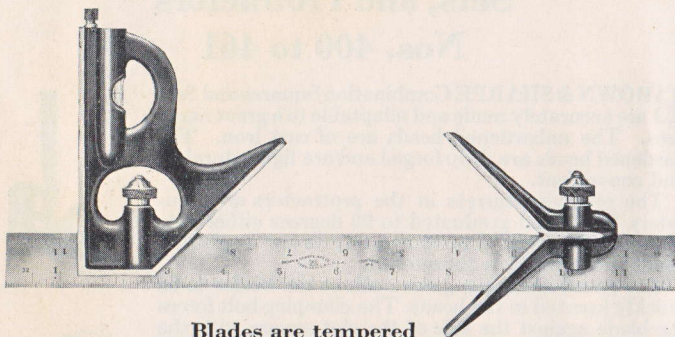
The ends of the center heads are ground on a radius and can be used on work of very large diameter.

The blades are tempered and graduated with the same care and accuracy as our steel rules. All parts are interchangeable.



## Combination Squares

### Nos. 400, 402, 404, 406, 408 and 410



Blades are tempered

With Hardened Heads			With Heads not Hardened		
No.	Size	Price	No.	Size	Price
<b>400</b> English	6 inch	\$3.90	<b>402</b> English	6 inch	\$2.40
	9 "	4.50		9 "	3.00
	12 "	4.80		12 "	3.60
	18 "	6.00		18 "	4.50
	24 "	6.60		24 "	5.40
<b>404</b> Metric	15 c/m	3.90	<b>406</b> Metric	15 c/m	2.40
	20 "	4.50		20 "	3.00
	30 "	4.80		30 "	3.60
	50 "	6.00		50 "	4.50
	60 "	6.60		60 "	5.40
<b>408</b> English and Metric	15 c/m	3.90	<b>410</b> English and Metric	15 c/m	2.40
	20 "	4.50		20 "	3.00
	30 "	4.80		30 "	3.60
	50 "	6.00		50 "	4.50
	60 "	6.60		60 "	5.40

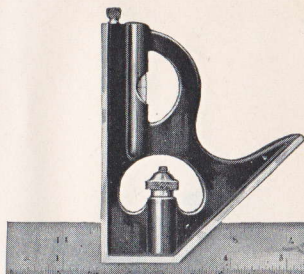
	GRADUATIONS	
Nos. 400 and 402	Nos. 404 and 406	Nos. 408 and 410
No. 4 or 7 See Page 75.	1st and 3rd corners: m/m 2nd and 4th corners: 1-2 m/m	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1-2 m/m 4th corner: 64ths"

Packed one in a box.

# Combination Squares

## Nos. 401, 403, 405, 407, 409 and 411

### Without Center Head



Blades are tempered

With Hardened Heads			With Heads not Hardened		
No.	Size	Price	No.	Size	Price
<b>401</b> English	4 inch	\$2.40	<b>403</b> English	4 inch	\$1.50
	6 "	3.00		6 "	1.80
	9 "	3.60		9 "	2.40
	12 "	3.90		12 "	3.00
	18 "	5.10		18 "	3.90
	24 "	5.70		24 "	4.80
<b>405</b> Metric	10 c/m	2.40	<b>407</b> Metric	10 c/m	1.50
	15 "	3.00		15 "	1.80
	20 "	3.60		20 "	2.40
	30 "	3.90		30 "	3.00
	50 "	5.10		50 "	3.90
	60 "	5.70		60 "	4.80
<b>409</b> English and Metric	10 c/m	2.40	<b>411</b> English and Metric	10 c/m	1.50
	15 "	3.00		15 "	1.80
	20 "	3.60		20 "	2.40
	30 "	3.90		30 "	3.00
	50 "	5.10		50 "	3.90
	60 "	5.70		60 "	4.80

#### GRADUATIONS

Nos. 401 and 403	Nos. 405 and 407	Nos. 409 and 411
No. 4 or 7 See Page 75.	1st and 3rd corners: m/m 2nd and 4th corners: 1-2 m/m	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1-2 m/m 4th corner: 64ths"

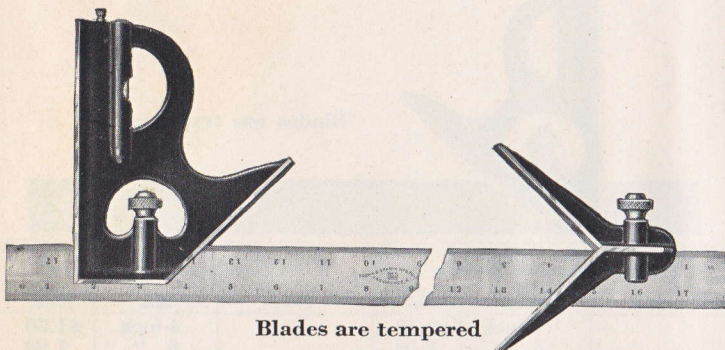
Packed one in a box.



# Combination Squares

## Nos. 412, 414, 420 and 422

**Heavy**



**Blades are tempered**

With Hardened Heads			With Heads not Hardened		
No.	Size	Price	No.	Size	Price
<b>412</b>	18 inch	<b>\$9.60</b>	<b>414</b>	18 inch	<b>\$8.70</b>
<b>English</b>	24 "	<b>11.10</b>	<b>English</b>	24 "	<b>10.20</b>
<b>420</b>	50 c/m	<b>9.60</b>	<b>422</b>	50 c/m	<b>8.70</b>
<b>English and Metric</b>	60 "	<b>11.10</b>	<b>English and Metric</b>	60 "	<b>10.20</b>

### GRADUATIONS

Nos. 412 and 414	Nos. 420 and 422
No. 4 See Page 75.	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1/2 m/m 4th corner: 64ths"

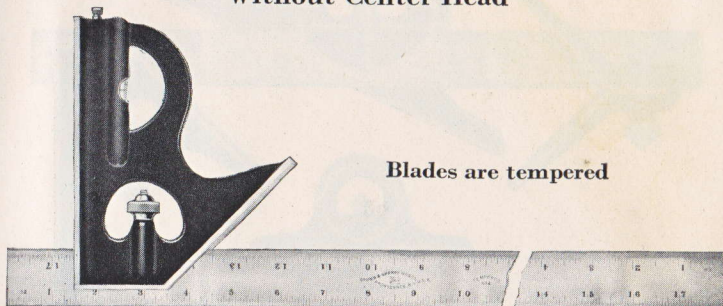
**Packed one in a box.**

# Combination Squares

## Nos. 413, 415, 421 and 423

Heavy

Without Center Head



Blades are tempered

### With Hardened Heads

No.	Size	Price
413	18 inch	\$7.20
English	24 "	8.70
421	50 c/m	7.20
English and Metric	60 "	8.70

### With Heads Not Hardened

No.	Size	Price
415	18 inch	\$6.60
English	24 "	8.10
423	50 c/m	6.60
English and Metric	60 "	8.10

### GRADUATIONS

Nos. 413 and 415

No. 4  
See Page 75.

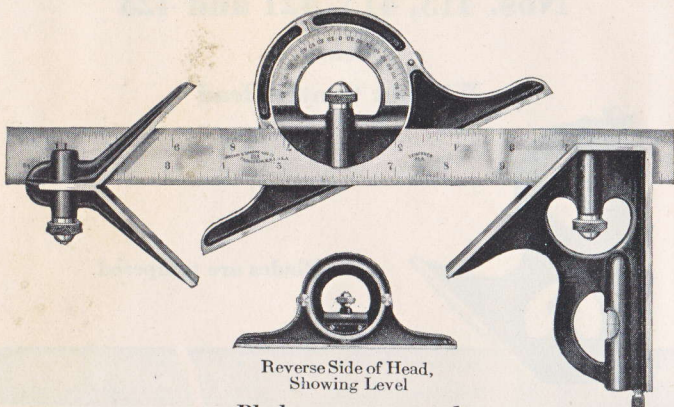
Nos. 421 and 423

1st corner: m/m  
2nd corner: 32nds"  
3rd corner: 1/2 m/m  
4th corner: 64ths"

Packed one in a box.

## Combination Sets

### Nos. 425, 426, 429, 430, 433 and 434



Blades are tempered

With Hardened Square and Center Heads			With Square and Center Heads Not Hardened		
No.	Size	Price	No.	Size	Price
<b>425</b> English	9 inch	\$7.50	<b>426</b> English	9 inch	\$6.00
	12 "	7.80		12 "	6.60
	18 "	9.00		18 "	7.50
	24 "	9.60		24 "	8.40
<b>429</b> Metric	20 c/m	7.50	<b>430</b> Metric	20 c/m	6.00
	30 "	7.80		30 "	6.60
	50 "	9.00		50 "	7.50
	60 "	9.60		60 "	8.40
<b>433</b> English and Metric	20 c/m	7.50	<b>434</b> English and Metric	20 c/m	6.00
	30 "	7.80		30 "	6.60
	50 "	9.00		50 "	7.50
	60 "	9.60		60 "	8.40

GRADUATIONS		
Nos. 425 and 426	Nos. 429 and 430	Nos. 433 and 434
No. 4 or 7 See Page 75.	1st and 3rd corners: m/m 2nd and 4th corners: 1-2 m/m	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1-2 m/m 4th corner: 64ths"

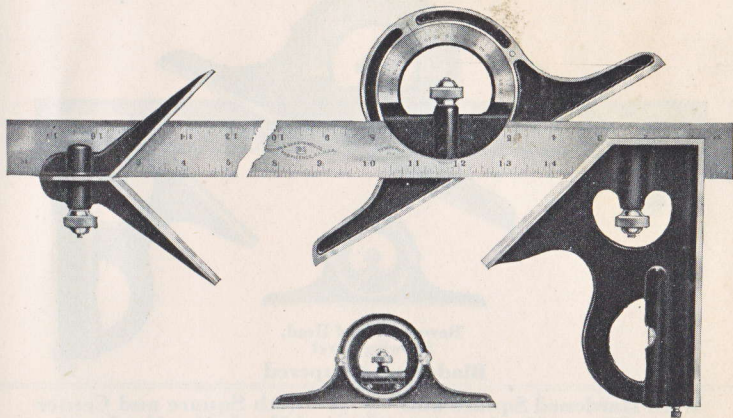
Packed one in a box.



# Combination Sets

## Nos. 427, 428, 435 and 436

### Heavy



Reverse Side of Head,  
Showing Level

**Blades are tempered**

#### With Hardened Square and Center Heads

No.	Size	Price
427	18 inch	\$13.20
English	24 "	14.40
435	50 c/m	13.20
English and Metric	60 "	14.40

#### With Square and Center Heads Not Hardened

No.	Size	Price
428	18 inch	\$12.60
English	24 "	13.20
436	50 c/m	12.60
English and Metric	60 "	13.20

#### GRADUATIONS

Nos. 427 and 428

No. 4  
See Page 75.

Nos. 435 and 436

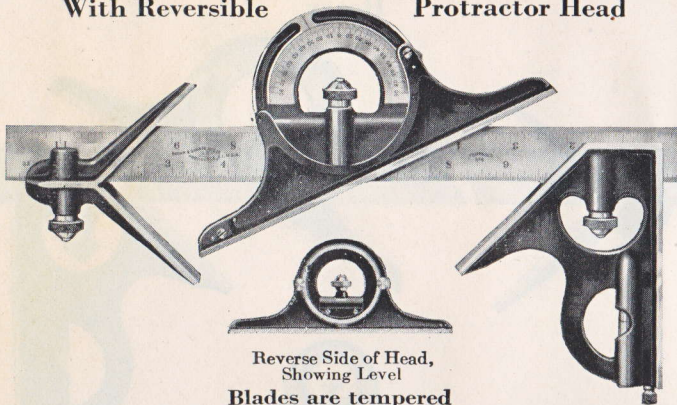
1st corner: m/m  
2nd corner: 32nds"  
3rd corner: 1-2 m/m  
4th corner: 64ths"

**Packed one in a box.**

## Combination Sets

### Nos. 438, 439, 442, 443, 446 and 447

With Reversible                      Protractor Head



With Hardened Square and Center Heads			With Square and Center Heads Not Hardened		
No.	Size	Price	No.	Size	Price
<b>438</b> <b>English</b>	9 inch	\$8.70	<b>439</b> <b>English</b>	9 inch	\$7.20
	12 "	9.00		12 "	7.50
	18 "	10.20		18 "	8.70
	24 "	10.80		24 "	9.60
<b>442</b> <b>Metric</b>	20 c/m	8.70	<b>443</b> <b>Metric</b>	20 c/m	7.20
	30 "	9.00		30 "	7.50
	50 "	10.20		50 "	8.70
	60 "	10.80		60 "	9.60
<b>446</b> <b>English</b> <b>and Metric</b>	20 c/m	8.70	<b>447</b> <b>English</b> <b>and Metric</b>	20 c/m	7.20
	30 "	9.00		30 "	7.50
	50 "	10.20		50 "	8.70
	60 "	10.80		60 "	9.60

#### GRADUATIONS

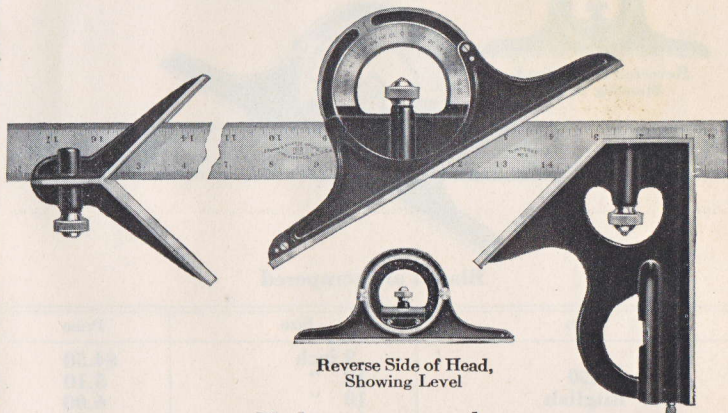
Nos. 438 and 439	Nos. 442 and 443	Nos. 446 and 447
No. 4 or 7 See Page 75.	1st and 3rd corners: m/m 2nd and 4th corners: 1/2 m/m	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1/2 m/m 4th corner: 64ths"

Packed one in a box.

# Combination Sets

## Nos. 440, 441, 448 and 449

Heavy  
With Reversible Protractor Head



Reverse Side of Head,  
Showing Level

Blades are tempered

With Hardened Square and Center Heads			With Square and Center Heads Not Hardened		
No.	Size	Price	No.	Size	Price
440 English	18 inch 24 "	\$14.10 15.60	441 English	18 inch 24 "	\$13.20 14.40
448 English and Metric	50 c/m 60 "	14.10 15.60	449 English and Metric	50 c/m 60 "	13.20 14.40

### GRADUATIONS

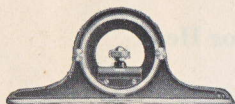
Nos. 440 and 441	Nos. 448 and 449
No. 4 See Page 75.	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1/2 m/m 4th corner: 64ths"

Packed one in a box.

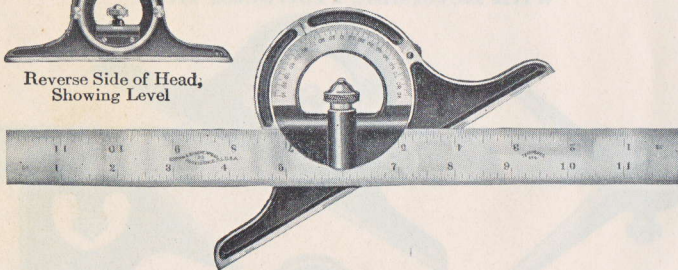


## Protractors

### Nos. 450, 452 and 454



Reverse Side of Head,  
Showing Level



**Blades are tempered**

No.	Size	Price
<b>450</b> English	9 inch	<b>\$4.50</b>
	12 "	<b>5.10</b>
	18 "	<b>6.00</b>
	24 "	<b>6.90</b>
<b>452</b> Metric	20 centimetres	<b>4.50</b>
	30 "	<b>5.10</b>
	50 "	<b>6.00</b>
	60 "	<b>6.90</b>
<b>454</b> English and Metric	20 centimetres	<b>4.50</b>
	30 "	<b>5.10</b>
	50 "	<b>6.00</b>
	60 "	<b>6.90</b>

#### GRADUATIONS

No. 450	No. 452	No. 454
No. 4 or 7 See Page 75.	1st and 3rd corners: m/m 2nd and 4th corners: 1-2 m/m	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1-2 m/m 4th corner: 64ths"

Packed one in a box.

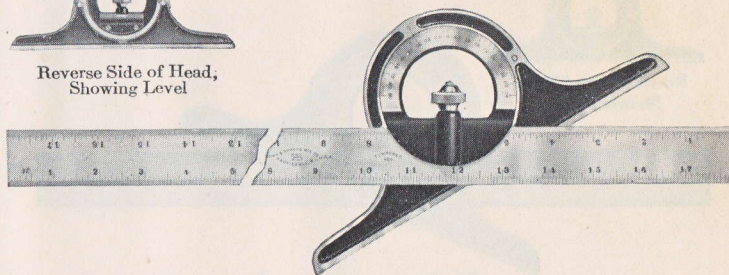
# Protractors

## Nos. 451 and 455

### Heavy



Reverse Side of Head,  
Showing Level



Blades are tempered

No.	Size	Price
<b>451</b> <b>English</b>	18 inch	<b>\$3.40</b>
	24 "	<b>9.60</b>
<b>455</b> <b>English and Metric</b>	50 centimetres	<b>3.40</b>
	60 "	<b>9.60</b>

#### GRADUATIONS

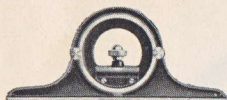
No. 451	No. 455
No. 4 See Page 75.	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1-2 m/m 4th corner: 64ths"

Packed one in a box.

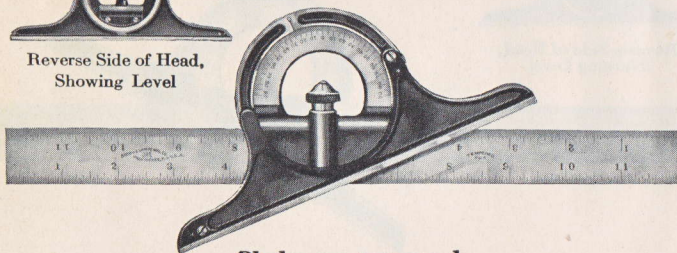
# Protractors

## Nos. 456, 458 and 460

### With Reversible Protractor Heads



Reverse Side of Head,  
Showing Level



**Blades are tempered**

No.	Size	Price
<b>456</b> <b>English</b>	9 inch	<b>\$5.40</b>
	12 "	<b>5.70</b>
	18 "	<b>6.90</b>
	24 "	<b>7.50</b>
<b>458</b> <b>Metric</b>	20 centimetres	<b>5.40</b>
	30 "	<b>5.70</b>
	50 "	<b>6.90</b>
	60 "	<b>7.50</b>
<b>460</b> <b>English and Metric</b>	20 centimetres	<b>5.40</b>
	30 "	<b>5.70</b>
	50 "	<b>6.90</b>
	60 "	<b>7.50</b>

#### GRADUATIONS

No. 456	No. 458	No. 460
No. 4 or 7 See Page 75.	1st and 3rd corners: m/m 2nd and 4th corners: 1-2 m/m	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1-2 m/m 4th corner: 64ths"

Packed one in a box.

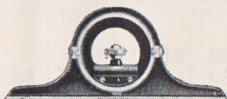


# Protractors

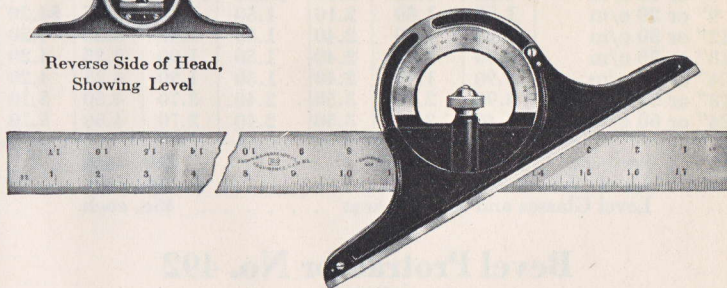
## Nos. 457 and 461

Heavy

With Reversible Protractor Head



Reverse Side of Head,  
Showing Level



Blades are tempered

No.	Size	Price
457 English	18 inch	\$9.00
	24 "	10.20
461 English and Metric	50 centimetres	9.00
	60 "	10.20

### GRADUATIONS

No. 457	No. 461
No. 4 See Page 75.	1st corner: m/m 2nd corner: 32nds" 3rd corner: 1-2 m/m 4th corner: 64ths"

Packed one in a box.

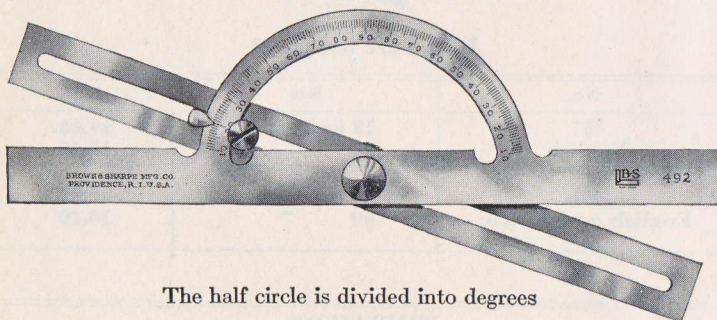
## Separate Parts

### FOR COMBINATION SQUARES, COMBINATION SETS AND PROTRACTORS

Size	Price of Blades	Price of Square Heads		Price of Center Heads		Price of Protractors	
	Tem- pered	Not Hardened	Hard- ened	Not Hardened	Hard- ened	Plain	Re- versible
4" or 10 c/m	\$0.90	\$1.20	\$1.50				
6" or 15 c/m	1.20	1.50	2.10	\$1.20	\$1.50		
9" or 20 c/m	1.50	1.50	2.10	1.50	1.90	\$3.25	\$4.20
12" or 30 c/m	1.90	1.90	2.40	1.50	1.90	3.25	4.20
18" or 50 c/m	3.00	1.90	2.40	1.50	1.90	3.25	4.20
24" or 60 c/m	3.90	1.90	2.40	1.50	1.90	3.25	4.20
18" or 50 c/m Hy.	3.90	2.70	3.50	2.40	2.70	4.50	5.10
24" or 60 c/m Hy.	5.40	2.70	3.50	2.40	2.70	4.50	5.10

Scribes . . . . . 20c. each  
 Level Glasses . . . . . 20c. each  
 Level Glasses and setting same . . . . . 45c. each

## Bevel Protractor No. 492

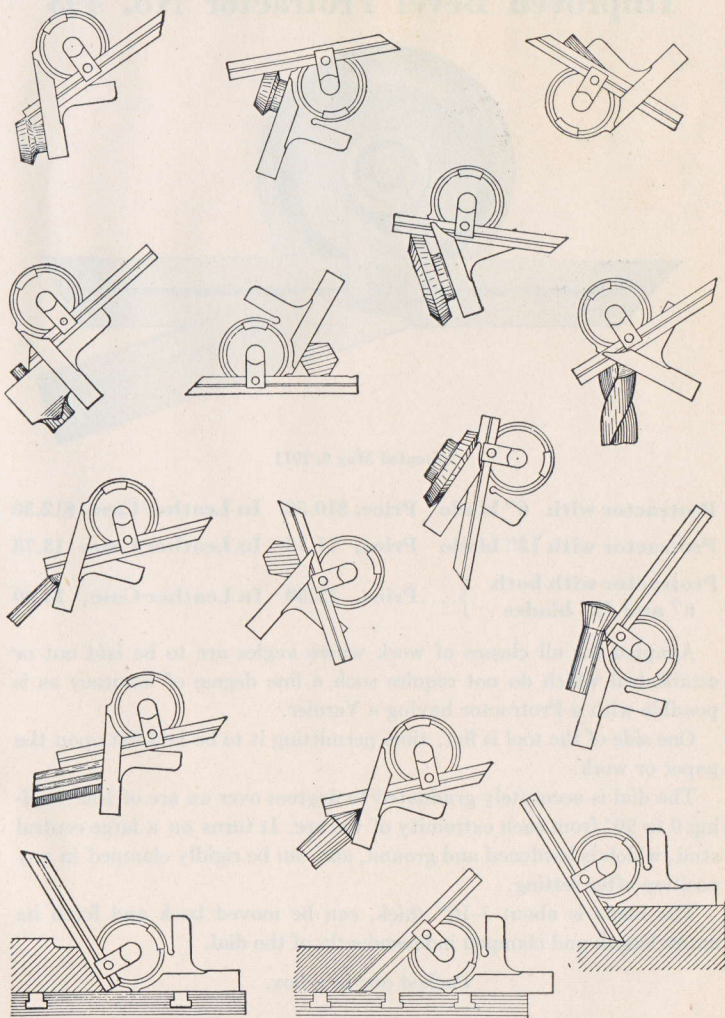


The half circle is divided into degrees

No.	Length of Sliding Arm, Inches	Price
492	6	\$10.00
	10	10.50

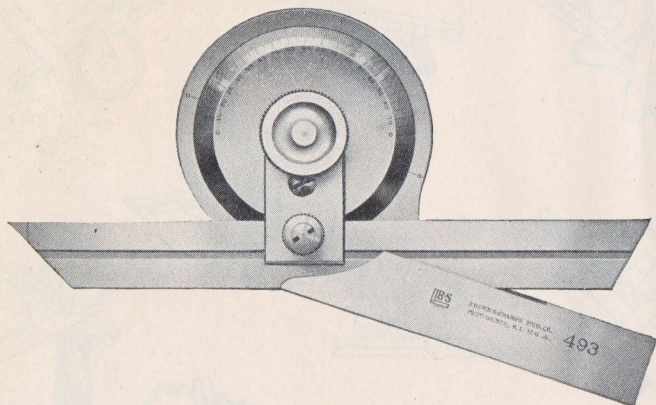
Packed one in a box.

## A Few Uses of the Bevel Protractor





## Improved Bevel Protractor No. 493



Patented May 9, 1911

<b>Protractor with 6" blade</b>	<b>Price, \$10.50</b>	<b>In Leather Case, \$12.30</b>
<b>Protractor with 12" blade</b>	<b>Price, 11.75</b>	<b>In Leather Case, 13.75</b>
<b>Protractor with both 6" and 12" blades</b>	<b>} . . . Price, 12.50</b>	<b>In Leather Case, 14.50</b>

Adapted for all classes of work where angles are to be laid out or established which do not require such a fine degree of accuracy as is possible with a Protractor having a Vernier.

One side of the tool is flat, thus permitting it to be laid flat upon the paper or work.

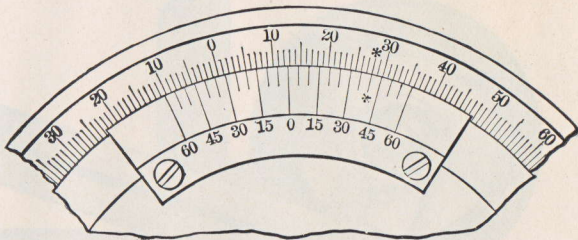
The dial is accurately graduated to degrees over an arc of 180° reading 0 to 90° from each extremity of the arc. It turns on a large central stud, which is hardened and ground, and can be rigidly clamped in any position after setting.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial.

Packed one in a box.

## Method of Reading the Vernier

### On Improved Universal Bevel Protractor



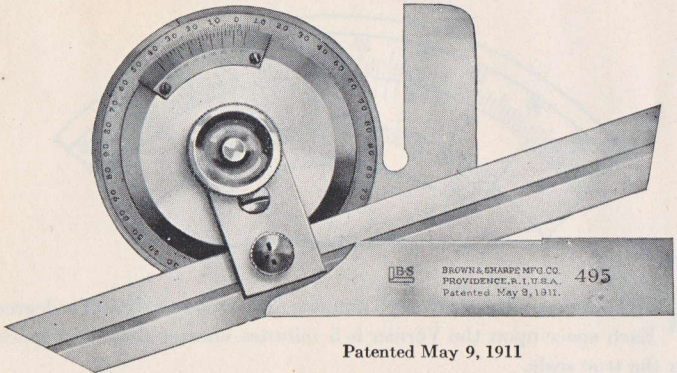
**T**HE Vernier indicates every 5 minutes ( $5'$ ), or one-twelfth of a degree. Each space upon the Vernier is 5 minutes shorter than two spaces on the true scale.

When the line marked 0 on the Vernier coincides with the line marked 0 on the true scale, the edges of the base and blade are parallel. When the swivel head is moved so the line on the Vernier next to 0 coincides with the line next but one to 0 on the true scale, the included angle of the base and blade has been changed one-twelfth of a degree, or 5 minutes.

**To Read the Protractor Setting.** Read off directly from the true scale the number of whole degrees between 0 and the 0 of the Vernier scale. Then count, in the same direction, the number of spaces from the 0 of the Vernier scale to a line that coincides with a line on the true scale; multiplying this number by 5, the product will be the number of minutes to be added to the whole number of degrees.

For example: As the Vernier is shown in the cut it has moved 12 whole degrees to the right of the 0 upon the true scale, and the 8th line on the Vernier coincides with a line upon the true scale as indicated by\*. Multiplying 8 by 5, the product, 40, is the number of minutes to be added to the whole number of degrees, thus indicating a setting of 12 degrees and 40 minutes ( $12^{\circ} 40'$ ).

## Improved Universal Bevel Protractor No. 495



Patented May 9, 1911

Protractor with 6" blade	Price, \$18.50	In Leather Case, \$20.50
Protractor with 12" blade	Price, 19.75	In Leather Case, 22.00
Protractor with both 6" and 12" blades	} ... Price, 20.50	In Leather Case, 22.75

Protractor No. 495 is well adapted for all classes of work where angles are to be laid out or established.

One side of the tool is flat, thus permitting it to be laid flat upon the paper or work.

The dial is accurately graduated to degrees the entire circle. The swivel turns on a large central stud, which is hardened and ground, and can be rigidly clamped by a thumb nut.

The graduations are below the surface, protecting them from wear.

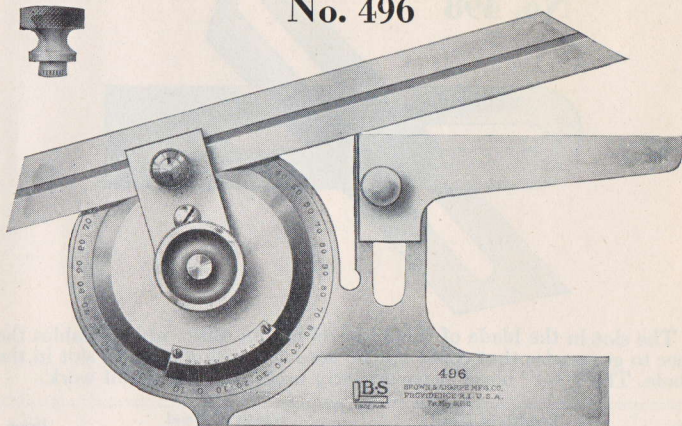
The Vernier adds materially to the use of the Protractor in obtaining fine measurements. It reads to 5 minutes or 1-12 of a degree.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial.

Packed one in a box.



# Improved Universal Bevel Protractor No. 496



## WITH ACUTE ANGLE ATTACHMENT

Patented May 9, 1911

Protractor with 6" blade	Price, \$22.50	In Leather Case, \$24.50
Protractor with 12" blade	Price, 23.75	In Leather Case, 26.00
Protractor with both 6" and 12" blades	} . . . Price, 24.50	In Leather Case, 26.75

The Improved Universal Bevel Protractor with Acute Angle Attachment is designed for all classes of work where angles are to be laid out and, with the attachment, extremely small angles can be easily and quickly established. Alignments are correct, and workmanship throughout the best.

One side of the tool is flat, thus permitting its being laid flat upon the paper or work. The dial is accurately graduated to degrees the entire circle, the graduated surface being depressed, thus protecting the graduations from wear.

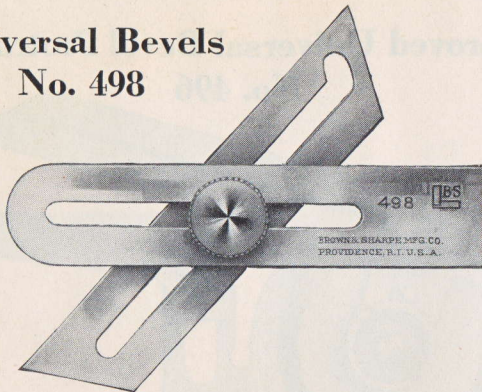
A Vernier, which reads to 5 minutes or one-twelfth of a degree, adds materially to the fineness to which angles can be laid out. A small thumb pinion is furnished for securing extremely fine adjustments. It is inserted in the back of the protractor and engages with a gear which swings the dial in either direction.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial.

Packed one in a box.

## Universal Bevels

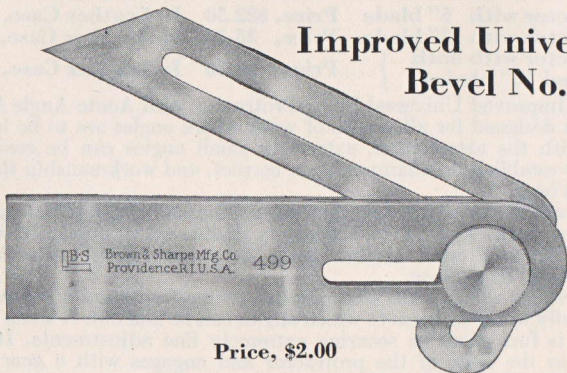
### No. 498



The slot in the blade of the 3" bevel has an offset which enables the user to get angles that could not be obtained with a straight slot in the blade. The 1 1/4" bevel is particularly useful on very small work.

No.	Length of Head and Tongue, Inches	Width of Head and Tongue, Inches	Price
498	1 1/4	1-4	\$2.40
	3	5-8	2.40

## Improved Universal Bevel No. 499



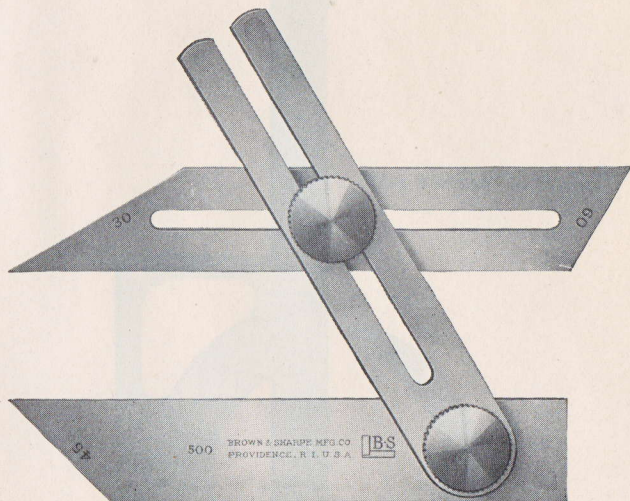
**Price, \$2.00**

The case is 3" long and is solid on the top for 1 1/2" from the square end, which forms a rest under the blade where work may be placed and accurately fitted.

Each of the above packed one in a box.

## Combination Bevel No. 500

Price, \$2.50



With this tool it is possible to transfer any angle from one surface to another. It can also be used for laying out angles as the back of the tool is smooth and can be laid flat on the work.

The stock is 4" long and has a stud riveted to it which holds the split blade. The blade can be swung to any angle and clamped by the knurled nut. The auxiliary blade is furnished with a clamp bolt and can be quickly attached to the slotted blade and clamped in position. One end of the stock is square and the other end is beveled to 45°. The auxiliary blade is beveled on one end to 60° and on the other end to 30°.

Packed one in a box.

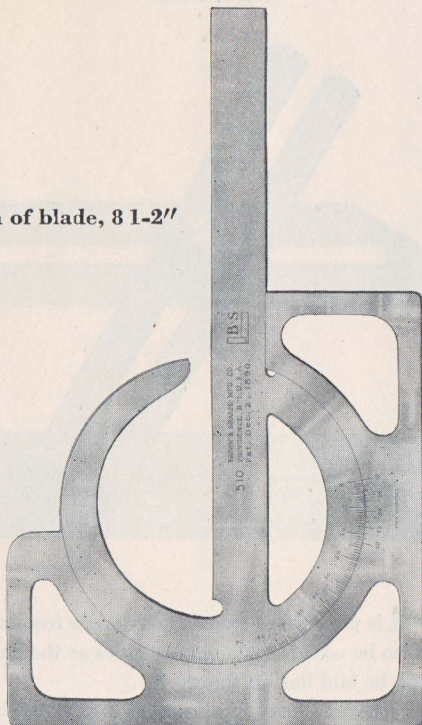


## Draughtsmen's Protractor No. 510

Price, \$10.00

In Leather Case, \$12.50

Length of blade, 8 1-2"



Can be quickly set to any angle, used either side up and on either of the two outside edges of the frame. It can be used to advantage in dividing a circle, transferring angles or laying off a given angle, without resetting, on either side of a line.

The Vernier reads to five minutes.

This Protractor forms a convenient extension of a T square and frequently takes the place of 45° and 60° triangles.

Packed one in a box.

# Table for Use with Draughtsmen's Protractor

## Table for Dividing Circles or Laying out Geometrical Figures

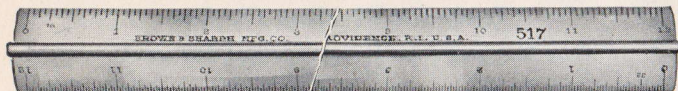
No. of Sides	Included Angle	Angles at Center of Circles	Angles for Sides of Figures
3	120°	30°	30°
4	90°	45°	45°
5	72°	18°-54°	36°-72°
6	60°	30°	30°
8	45°	45°	22° 30'
10	36°	54°-18°	18°-54°
12	30°	60°	15°-45°
14	25° 43'	64° 17'-38° 34'-12° 51'	12° 51'-38° 34'-64° 17'
16	22° 30'	67° 30'-45°	11° 15'-33° 45'
18	20°	70°-50°-30°-10°	10°-30°-50°-70°
20	18°	72°-54°	9°-27°-45°
24	15°	75°-60°-45°	7° 30'-22° 30'-37° 30'

## Tapers per Foot and Corresponding Angles

Taper Per Foot, Inches	Included Angle	Angle with Center Line	Taper Per Foot, Inches	Included Angle	Angle with Center Line
1-8	0°-36'	0°-18'	1	4°-46'	2°-23'
1-4	1 -12	0 -36	1 1-2	7 -09	3 -35
5-16	1 -30	0 -45	1 3-4	8 -20	4 -10
3-8	1 -47	0 -54	2	9 -31	4 -46
7-16	2 -05	1 -02	2 1-2	11 -54	5 -57
1-2	2 -23	1 -12	3	14 -15	7 -08
3-4	3 -35	1 -47	3 1-2	16 -36	8 -18
15-16	4 -28	2 -14	4	18 -55	9 -28

# Improved Scales for Draughtsmen

## No. 517



These Scales are of steel, nickel plated, and of a design combining lightness with strength. A 12" scale weighs but 2 1-2 oz. The under side of the scale is beveled, thus bringing the graduated side close to the work, a distinct advantage in laying out work accurately. Each scale is graduated on the two upper edges for its entire length and each graduation is the same for the full length of the rule, thus eliminating the confusion caused by many dissimilar graduations on one edge.

No.	Length, Inches	Graduation	Price
517	6	On one edge 1-64" other edge 1-100"	\$1.70
	6	On one edge 1-32" other edge 1-64"	1.70
	6	On one edge 1-16" other edge 1-32"	1.70
	12	On one edge 1-64" other edge 1-100"	2.00
	12	On one edge 1-32" other edge 1-64"	2.00
	12	On one edge 1-16" other edge 1-32"	2.00

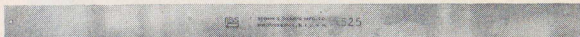
**Special Scales Made to Order**

**Prices on Application**

Packed one in a box.



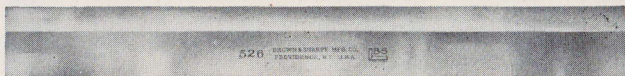
## Draughtsmen's Steel Straight Edges No. 525



Straight Edges are convenient for laying out long angular lines on full size drawings of machines, etc. They are made of tool steel, accurately ground, light and easy to handle.

No.	Length, Inches	Width, Inches	Approximate Thickness, Inches	Price
525	15	1 1-4	3-64	\$2.30
	18	1 1-2	3-64	2.60
	24	1 1-2	3-64	3.00
	30	1 3-4	3-64	4.00
	36	2	1-16	5.25
	42	2 1-4	1-16	6.50
	48	2 1-2	1-16	8.00
	60	2 3-4	5-64	12.00
	72	2 3-4	5-64	15.00

## Beveled Steel Straight Edges No. 526

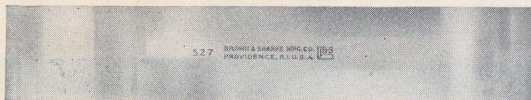


These straight edges are made relatively thick, to insure rigidity. They are beveled on one edge only, the beveled edge being 1-16" in thickness.

No.	Length, Inches	Width, Inches	Thickness, Inches	Price
526	12	1 3-8	3-16	\$3.00
	18	1 3-4	3-16	4.40
	24	2	1-4	6.75
	36	3	1-4	11.50
	48	3	1-4	16.25
	60	3 1-8	9-32	22.00
	72	3 1-8	9-32	32.00

Each of the above packed one in a package.

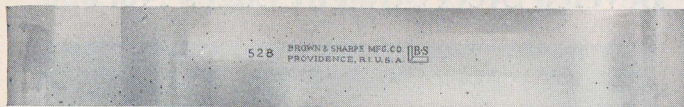
## Hardened Steel Straight Edges No. 527



These Straight Edges are hardened on the edges only. They are very serviceable where hard and continued use is required of them.

No.	Length, Inches	Width, Inches	Approximate Thickness, Inches	Price
527	3 7-8	15-16	1-16	\$1.00
	5 1-2	1 1-8	5-64	1.50
	7	1 3-8	5-64	1.75
	10 3-4	1 3-4	5-64	3.00
	13 3-4	2 1-16	5-64	4.00
	17	2 7-16	5-64	6.00
	20	2 7-8	7-64	7.00
	27	3	7-64	9.00
	33	3 1-4	1-8	12.00
	39	3 5-8	1-8	15.00

## Standard Steel Straight Edges No. 528



These Straight Edges are not hardened.

No.	Length, Inches	Width, Inches	Approximate Thickness, Inches	Price
528	6	1	5-64	\$0.75
	9	1 1-16	5-64	1.25
	12	1 1-4	5-64	1.75
	18	1 1-2	3-32	2.75
	24	2	3-32	4.00
	36	2 1-2	7-64	6.50
	48	3	7-64	11.00
	60	3	1-8	16.00
	72	3	1-8	22.00

Each of the above packed one in a package.

# Toolmakers' Knife-Edge Straight Edges

## No. 530



For work requiring extreme accuracy, the knife-edge straight edge is commonly used. The testing edge is very narrow and is of semicircular cross section so that a line contact is obtained instead of a flat contact, as with straight edges having flat edges. This line contact shows any minute curvatures which may exist, and as the edge is curved, the accuracy of the test will not be affected if the straight edge is not held exactly at right angles with the surface being tested.

No.	Length, Inches	Width, Inches	Price
530	2 1-4	13-16	\$3.30
	3 1-4	13-16	4.50
	4 1-2	13-16	5.70
	6 1-4	13-16	8.40

The above Straight Edges are furnished in cloth-covered cases.

	Price
Test bar in cloth-covered case.....	\$4.80
Leather case for complete set.....	1.25
Cloth-covered case for test bar.....	.30
Cloth-covered case for single straight edge.....	.30

Packed one in a box.



## Toolmakers' Knife-Edge Straight Edge Set No. 531



**Price, Complete in Leather Case, \$25.20**

Consists of Glass Test Bar and 4 Straight Edges, 1 each, 2 1-4", 3 1-4", 4 1-2" and 6 1-4" long.

## Narrow-Edge Straight Edge Set No. 536

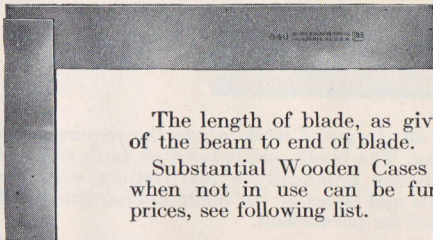
Consists of six Narrow-Edge Straight Edges, of tempered steel, being 5-64" thick and 19-32" wide. They are 1-2", 3-4", 1", 1 1-4", 1 1-2" and 2" long.



**Price, Complete in Leather Case, ~~\$6.00~~ \$4.50**

Each of the above packed one set in a box.

## Hardened Cast Steel Try Squares No. 540

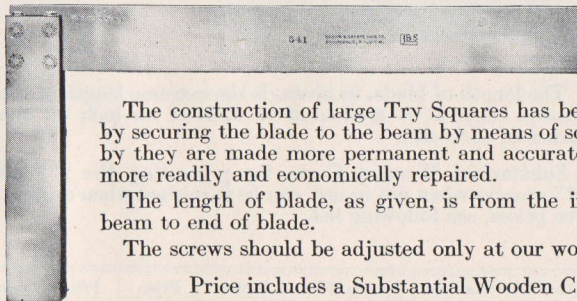


The length of blade, as given, is from the inner edge of the beam to end of blade.

Substantial Wooden Cases for protecting the Squares when not in use can be furnished when desired. For prices, see following list.

No.	Length of Blade, Inches	Length of Beam, Inches	Price	Price of Case
540	1 1-2	1 9-16	\$3.60	\$2.25
	3	2 7-16	4.50	2.25
	4 1-2	3 9-16	6.90	2.50
	6	4 3-8	9.00	2.50
	9	5 5-8	13.50	2.75
	12	7 1-8	18.00	3.00
	15	8 3-16	30.00	4.00
	18	10 1-4	34.50	4.50

## Improved Hardened Cast Steel Try Squares No. 541



The construction of large Try Squares has been improved by securing the blade to the beam by means of screws, whereby they are made more permanent and accurate and can be more readily and economically repaired.

The length of blade, as given, is from the inner edge of beam to end of blade.

The screws should be adjusted only at our works.

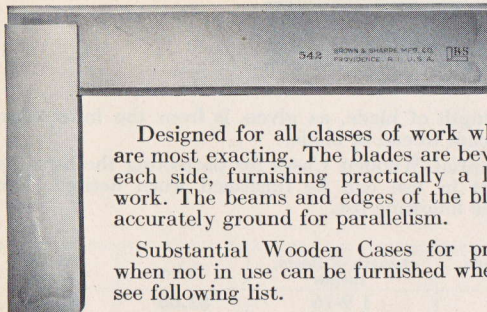
Price includes a Substantial Wooden Case.

No.	Length of Blade, Inches	Length of Beam, Inches	Price
541	24	13 1-8	\$51.50
	30	16 1-4	68.50
	36	19 1-2	85.50

Each of the above packed one in a box.



## Steel Squares with Beveled Edges No. 542



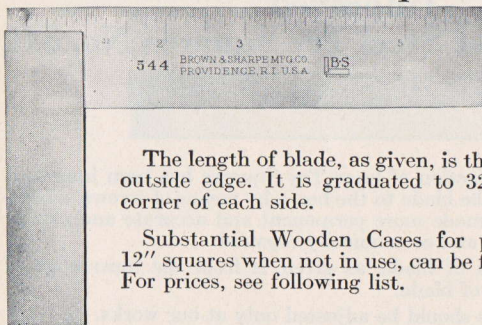
**Hardened**

Designed for all classes of work where the requirements are most exacting. The blades are beveled on both edges of each side, furnishing practically a line contact with the work. The beams and edges of the blade are hardened and accurately ground for parallelism.

Substantial Wooden Cases for protecting the squares when not in use can be furnished when desired. For prices, see following list.

No.	Length of Blade, Inches	Length of Beam, Inches	Price	Price of Case
542	1 1-2	1 9-16	\$4.20	\$2.25
	3	2 7-16	5.70	2.25
	4 1-2	3 9-16	8.40	2.50
	6	4 3-8	11.40	2.50

## Graduated Steel Squares No. 544



**Not Hardened**

The length of blade, as given, is the extreme length of the outside edge. It is graduated to 32ds of an inch on one corner of each side.

Substantial Wooden Cases for protecting the 9" and 12" squares when not in use, can be furnished when desired. For prices, see following list.

No.	Length of Blade, Inches	Length of Beam, Inches	Price	Price of Case
544	3	2	\$3.90	
	4	2 9-16	5.70	
	6	3 3-4	7.50	
	9	5	12.00	\$2.75
	12	6 1-16	14.40	3.00

Each of the above packed one in a box.



## Thin Steel Squares No. 547



**Graduated**

The 2" and 3" squares are graduated in 16ths and 64ths of an inch on one inside and one outside corner of one side and similarly to 32ds and 64ths on the other.

The 4", 6", 8", and 10" are graduated on both sides to 16ths and 32ds of an inch.

No.	Length of Blade, Inches	Width of Blade, Inches	Price
547	2	1-2	\$2.10
	3	5-8	2.70
	4	3-4	3.60
	6	1	5.10
	8	1 1-8	6.60
	10	1 1-4	8.10

Packed as follows: 2" to 6", inclusive, six in a box; 8" and 10", one in a package.



## Steel Square For Millwrights No. 550

**Price, \$17.00**

Designed to meet the wants of those desiring a more accurate tool than the ordinary carpenter's square.

Long blade, 24" long, 2" wide

Short blade, 18" long, 1 1-2" wide

Both blades are 5-32" thick at the corner where they unite, and taper down to 1-16" at their ends. They have similar graduations on both sides, one inside and outside corner being graduated in 8ths and the other inside and outside corners graduated in 16ths. One inside and outside corner of one side has the first inch graduated in 64ths and the second inch in 32ds and similarly on the other side.

Packed one in a package.

## Die Makers' Square No. 552

Price, \$4.50

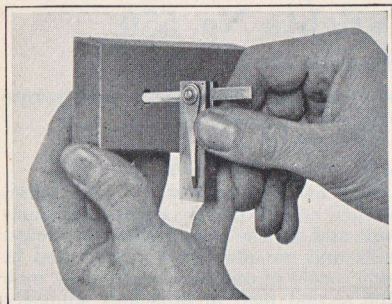
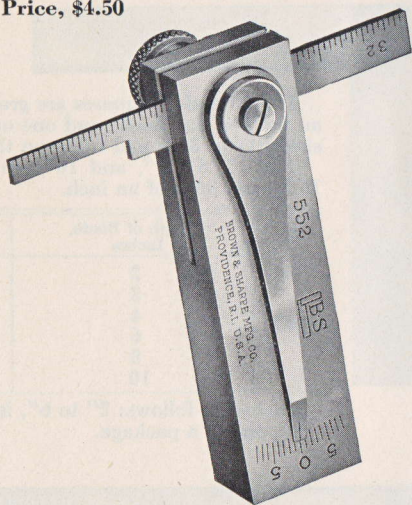
This square is a tool with which die clearances are quickly and easily obtained and is also very useful to the pattern maker for getting angles and drafts on patterns.

The blade can be set for any angle up to 8 degrees either side of the zero. When so set the graduation on the pointer takes the same angle as the blade and the number of degrees are accurately registered on the graduated body.

The blade is graduated for one inch from either end in 32nds of an inch on one side, and 64ths of an inch on the other. One end is made

narrow, being  $\frac{7}{64}$ ths of an inch wide for  $\frac{5}{8}$ ths of an inch, the remainder of the length being  $\frac{7}{32}$ nds of an inch wide. The narrow end of the blade is very useful in small holes and narrow dies.

The body of the square is hardened and ground, and is approximately 2 1-4" long, 5-8" wide, and 3-8" thick.

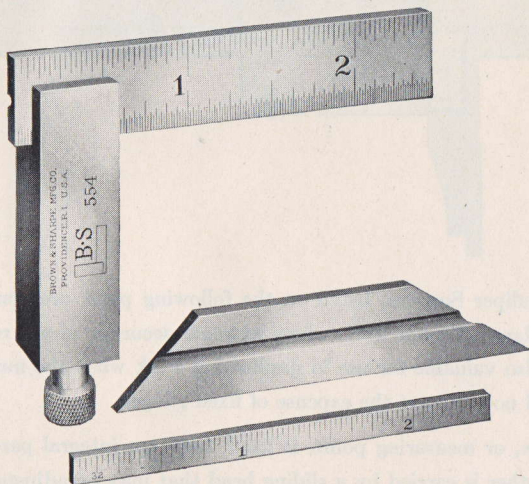


Packed one in a box.

## Adjustable Square No. 554

Price {	Square .....	\$3.60
	Square, with either bevel or narrow blade .....	3.90
	Square, complete .....	4.20

Square sent complete unless otherwise ordered.



The blades of this square may be adjusted to any length and can be used in places where it would be impossible to use a square with a fixed blade. It is particularly useful to toolmakers on small work.

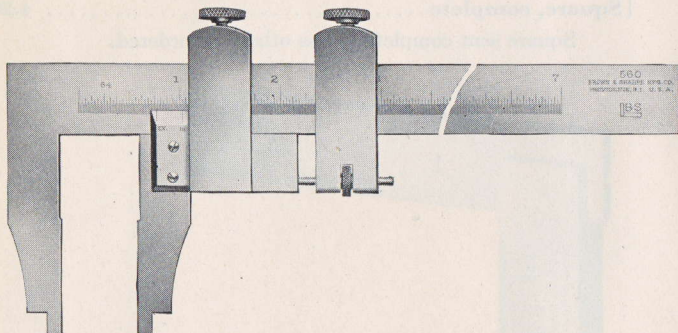
The blades are so held in the beam as to insure accuracy between the blade and the body.

The blade with the beveled ends can be used to advantage in checking angles, establishing 60 and 45 degree angles, and checking thread tools. It finds a large variety of uses around the shop. The narrow blade is graduated on one side in 32nds of an inch and can be used in small holes where an ordinary try square could not be used.

Packed one in a box.



## Caliper Squares Nos. 560, 561 and 562



**T**HE Caliper Squares, listed on the following page, are convenient for a large class of work where extreme accuracy is not required, and are also valuable for use in duplicating work when the number of pieces will not warrant the expense of fixed gauges.

One jaw, or measuring point, is fixed, being an integral part of the bar, the other is carried by a sliding head that may be adjusted along the bar.

Quick adjustment of the points is secured by releasing both clamping screws and sliding the adjustable head the required distance along the bar.

Fine adjustment of the points may then be made by clamping the thumb screw at the right and turning the knurled nut on the horizontal screw.

These Caliper Squares take inside as well as outside measurements and have hardened jaws.

## Caliper Squares No. 560

No.	Size, Inches	Length of Jaws, Inches	Width of Jaws Closed, Inches	Price Without Adjusting Screw	Price With Adjusting Screw	Price of Case
560	4	1 1-2	1-4	\$9.00	\$10.20	\$1.75
	6	2	1-4	10.80	13.20	2.00
	9	3 1-4	3-8	15.00	17.40	3.00

Graduation—One side in 64ths, other side in 100ths of an inch.

## Caliper Squares No. 561

### METRIC MEASURE

No.	Size, m/m	Length of Jaws, m/m	Width of Jaws Closed, m/m	Price Without Adjusting Screw	Price With Adjusting Screw	Price of Case
561	100	38	6	\$9.00	\$10.20	\$1.75
	150	50	6	10.80	13.20	2.00
	250	80	10	15.00	17.40	3.00

Graduation—One side in half millimetres, other side in millimetres.

## Caliper Squares No. 562

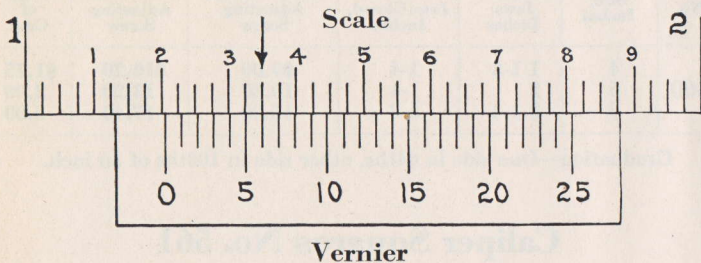
### ENGLISH AND METRIC MEASURE

No.	Length of English Graduation, Inches	Length of Metric Graduation, m/m	Length of Jaws Inches m/m	Width of Jaws Inches m/m	Price Without Adjust- ing Screw	Price With Adjust- ing Screw	Price of Case
562	4	100	1 1-2 or 38	1-4 or 6	\$9.00	\$10.20	\$1.75
	6	150	2 or 50	1-4 or 6	10.80	13.20	2.00
	9	250	3 1-4 or 80	3-8 or 10	15.00	17.40	3.00

Graduation—One side in half millimetres, other side in 100ths of an inch.

Each of the above packed one in a box.

## Description of the Vernier and Its Use



ON the bar of the instrument is a line of inches numbered 0, 1, 2, etc., each inch being divided into ten parts and each tenth into four parts, making forty divisions to the inch. On the sliding jaw is a line of divisions (called a Vernier, from the inventor's name) of twenty-five parts, numbered 0, 5, 10, 15, 20, 25. The twenty-five parts on the Vernier correspond, in extreme length, with twenty-four parts, or twenty-four fortieths of an inch on the bar; consequently each division on the Vernier is smaller than each division on the bar by one thousandth part of an inch. If the sliding jaw of the Caliper is pushed up to the other jaw so that the line marked 0 on the Vernier corresponds with the 0 on the bar, then the two next lines to the right will differ from each other by one-thousandth of an inch, and so the difference will continue to increase, one-thousandth of an inch for each division, till they again correspond at the line marked 25 on the Vernier. To read the distance the Caliper is open, commence by noticing how many inches, tenths, and parts of tenths the zero point on the Vernier has been moved from the zero point on the bar. Now count upon the Vernier the number of divisions,



until one is found which coincides with the one on the bar, which will be the number of thousandths to be added to the distance read off on the bar. The best way of expressing the value of the divisions on the bar is to call the tenths one hundred thousandths (.100) and the fourths of tenths, or fortieths, twenty-five thousandths (.025).

For example:

As the Vernier is shown in the cut it has been moved to the right one and two-tenths inches, or 1.200", as indicated by the bar; and the sixth line on the Vernier coincides with a line on the bar, thus making six thousandths (.006) of an inch to be added to the reading from the scale, which would make the total reading one and two hundred and six thousandths inches (1.206").

### **How to Read inside measurements with a Vernier Caliper Graduated in English and Metric Measure**

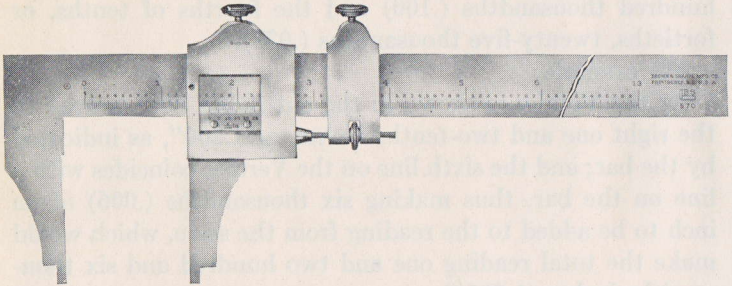
With the combination English and Metric Verniers, the caliper points are the same width as those of the plain English. Where both the inside and outside measurements are taken from the same side of the Caliper, the inside measurements are obtained as follows:

On the English Measure side of the 6" Vernier, two and one-half tenths or two hundred and fifty thousandths (.250) of an inch should be added to the apparent reading of the Caliper for the space occupied by the caliper points. With the 12" and 24" Verniers, three-tenths or three hundred thousandths (.300) of an inch, and with the 36", one-half or five hundred thousandths (.500) of an inch.

On the Metric Measure side of the Vernier 6.35 m/m should be added to the apparent reading of the 150 m/m, 7.62 m/m to the 300 m/m, and 600 m/m Calipers, and 12.70 m/m to the 900 m/m Caliper.

## Vernier Calipers

### Nos. 570, 571 and 572



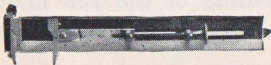
**T**HE Vernier Caliper shown in the lower left corner of the page was invented by Jos. R. Brown in 1851, and, as far as is known, was "the first practical precision tool within the reach of the ordinary mechanic."

The Vernier Calipers listed on the opposite page (with the exception of No. 572) take inside as well as outside measurements direct. They are graduated to read on one side for outside, and on the other side for inside measurements. This feature enables the user to read either inside or outside measurements direct from the caliper without calculation.

With the English and Metric Caliper, No. 572, it is necessary to add the thickness of the measuring points to the caliper reading for inside measurements.

The jaws are hardened and ground. Points are placed on the bars and slides so that dividers can be set to transfer distances.

A 1-4" Standard Internal Cylindrical Gauge is furnished when desired, for testing the accuracy of the adjustment of the Caliper. **Price of Standard, \$4.50 extra.**



The first and original Vernier Caliper, so far as is known, invented in 1851, by Jos. R. Brown.

## Vernier Calipers No. 570

Graduated on both front and back to read, by means of a Vernier, to thousandths of an inch.

No.	Length of Graduation, Inches	Length of Jaws, Inches	Approximate Width of Jaws Closed, Inches	Price With Case	Price Without Case
570	6	1 1-4	1-4	\$26.75	\$24.00
	12	2 1-4	3-10	34.00	30.00
	24	2 1-4	3-10	49.00	42.00
	36	2 3-4	1-2	87.00	72.00

## Vernier Calipers No. 571

### METRIC MEASURE

Graduated on both front and back to read, by means of a Vernier, to 50ths of a millimetre.

No.	Length of Graduation, m/m	Length of Jaws, m/m	Approximate Width of Jaws Closed, m/m	Price With Case	Price Without Case
571	150	31	6	\$26.75	\$24.00
	300	57	6	34.00	30.00
	600	57	6	49.00	42.00
	900	69	12	87.00	72.00

## Vernier Calipers No. 572

### ENGLISH AND METRIC MEASURE

This Caliper reads in both English and Metric Measure. Graduated to read in thousandths of an inch on one side and 50ths of a millimetre on the other.

No.	Length of Graduation, Inches m/m	Length of Jaws, Inches m/m	Approximate Width of Jaws Closed, Inches m/m	Price With Case	Price Without Case
572	6 or 150	1 1-4 or 31	1-4 or 6	\$26.75	\$24.00
	12 or 300	2 1-4 or 57	3-10 or 8	34.00	30.00
	24 or 600	2 1-4 or 57	3-10 or 8	49.00	42.00
	36 or 900	2 3-4 or 69	1-2 or 13	87.00	72.00

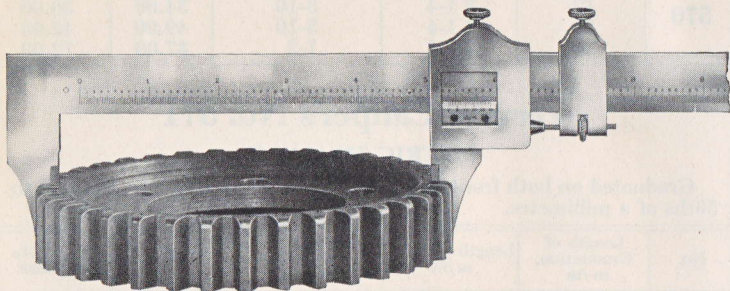
All Vernier Calipers listed on this page are furnished in cases, unless otherwise ordered.

Each of the above packed one in a box.



## Depth of Gear Tooth Vernier Caliper No. 573

**For Determining Accurately the Depth of Gear Teeth  
ENGLISH OR METRIC MEASURE**



**Price, in finished wooden case, \$34.00**

**Price, without case ..... 30.00**

**Furnished in case unless otherwise ordered.**

Measuring the bottom diameter of gears provides an accurate check on the cutting operation and insures the duplication of any desired standard.

This tool, therefore, is found especially valuable in the Automotive Shop for measuring transmission gears where it is impossible to use our regular Vernier Calipers on account of the thickness of the jaws.

Being very similar to our 12" Vernier Caliper with the exception of the shape of the jaws, this tool can also be used for outside measurements.

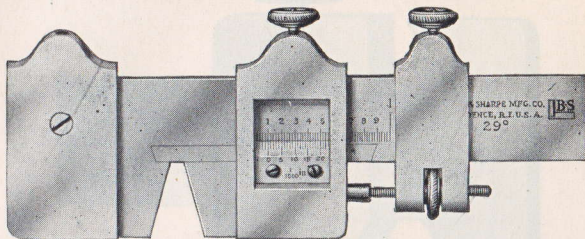
Graduated on one side only.

Depth of jaws, 1 7-8" or 46 m/m. Width of measuring surface, 1/32" or 3/10 m/m.

Packed one in a box.

# Thread Tool Verniers No. 576

ENGLISH AND METRIC MEASURE



**60° Thread Tool Vernier, in Leather Case, \$26.75**

**55° Thread Tool Vernier, in Leather Case, \$26.75**

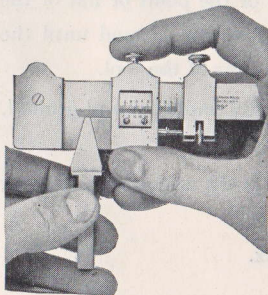
**29° Thread Tool Vernier, in Leather Case, \$26.75**

**Price Without Case, \$25.00**

Furnished in case unless otherwise ordered.

This tool is recommended to the manufacturer looking for an extremely accurate instrument for measuring thread tools of different pitches, as it eliminates the necessity of keeping a large number of gauges on hand.

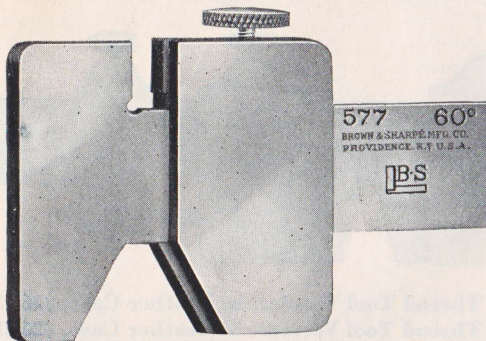
When in use, the sliding jaw is set for the width of point of tool of the required pitch. The thread tool is then ground so that the point bottoms on the hardened steel strip inserted in the blade and the sides rest against the jaws of the tool.



The jaws or measuring surfaces are carefully hardened and ground, the angle being carefully tested for accuracy. The Vernier reads in thousandths of an inch on one side of the tool and in 50ths of a millimetre on the other. The tool is graduated for one inch and twenty-five millimetres on the respective sides.

Packed one in a box.

## Thread Tool Gauges No. 577



**60° Worm Thread Tool Gauge, \$6.75**

**55° Worm Thread Tool Gauge, 6.75**

**29° Worm Thread Tool Gauge, 6.75**

**Leather Case, Price, \$1.75**

This tool can be accurately set by inserting a plug gauge or a thickness gauge blade in the opening on the top. The sliding jaw is clamped by the knurled screw and set for the width of the point or flat of the tool for the required pitch. The thread tool is then ground until the point bottoms and the sides rest against the jaws of the tool.

The jaws or measuring surfaces are carefully hardened and ground, the angles being carefully tested for accuracy.

These gauges cover all pitches and eliminate the necessity of keeping a large number of individual gauges on hand.

Packed one in a box.



# Gear Tooth Verniers Nos. 580 and 581

## No. 580

### ENGLISH MEASURE

Reads to thousandths of an inch  
20 diametral to 2 diametral pitch

Price, in Leather Case . . . \$42.75

Price, without Case . . . . 40.00

10 diametral to 1 diametral pitch

Price, in Wooden Case . . \$63.00

Price, without Case . . . . 60.00

## No. 581

### METRIC MEASURE

Reads to fiftieths of a millimetre

1 1/4 m/m to 12 m/m module

Price, in Leather Case . . . \$42.75

Price, without Case . . . . 40.00

2 1-2 m/m to 25 m/m module

Price, in Wooden Case . . \$63.00

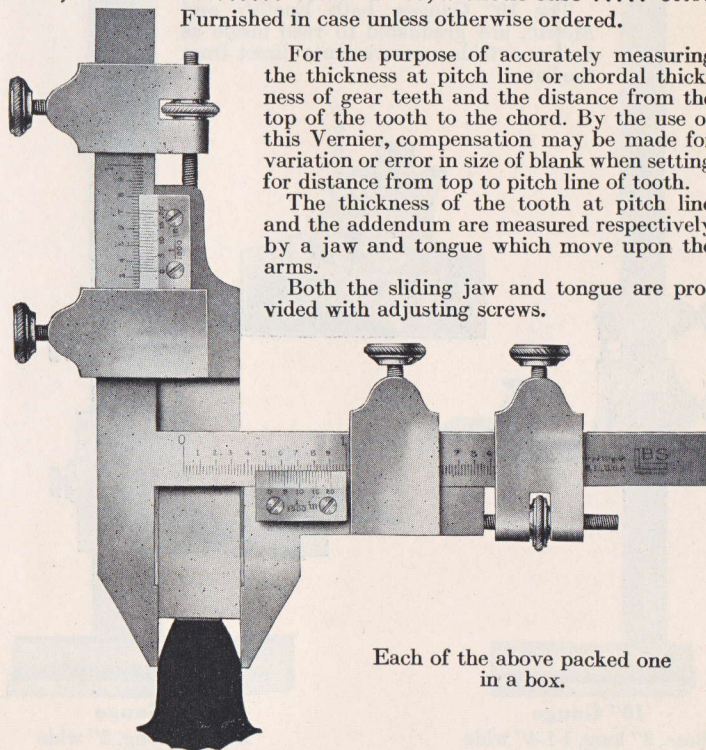
Price, without Case . . . . 60.00

Furnished in case unless otherwise ordered.

For the purpose of accurately measuring the thickness at pitch line or chordal thickness of gear teeth and the distance from the top of the tooth to the chord. By the use of this Vernier, compensation may be made for variation or error in size of blank when setting for distance from top to pitch line of tooth.

The thickness of the tooth at pitch line and the addendum are measured respectively by a jaw and tongue which move upon the arms.

Both the sliding jaw and tongue are provided with adjusting screws.



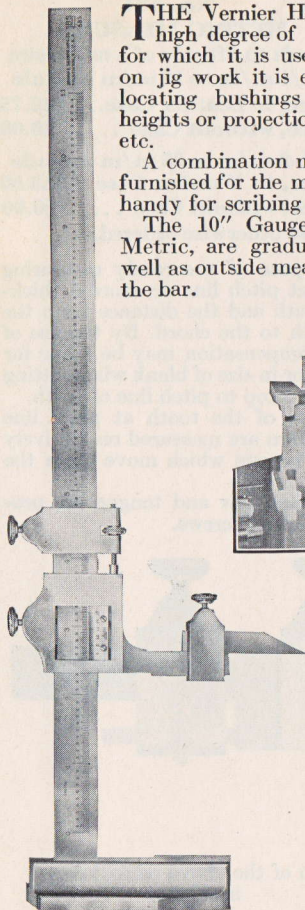
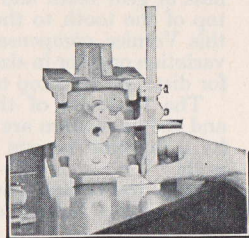
Each of the above packed one in a box.

## Vernier Height Gauges No. 585

**T**HE Vernier Height Gauge brings a high degree of accuracy to any work for which it is used. In the tool room on jig work it is especially desirable for locating bushings in jigs and getting heights or projections from plane surfaces, etc.

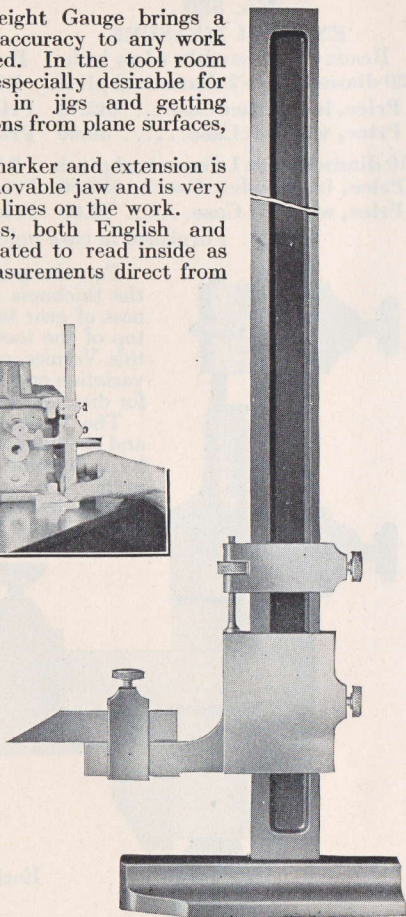
A combination marker and extension is furnished for the movable jaw and is very handy for scribing lines on the work.

The 10" Gauges, both English and Metric, are graduated to read inside as well as outside measurements direct from the bar.



**10" Gauge**

Base, 3" long, 1 1/4" wide  
3-4" high.



**18" Gauge**

Base, 5" long, 2" wide  
7-8" high.

## Vernier Height Gauges No. 585

ENGLISH, METRIC, OR ENGLISH AND METRIC MEASURE

### 10'' Height Gauge

Price, in Leather Case, \$41.00

Price, without Case . . . 36.00

Furnished in Case unless otherwise ordered.

**English Measure.** Graduated to read on one side, between the jaws, from 0 to 10'', and on the other side, outside the jaws, from 1 1-8'' to 10'' by thousandths of an inch.

**Metric Measure.** Graduated to read on one side, between the jaws, from 0 to 25 c/m, and on the other side, outside the jaws, from 28 m/m to 25 c/m by 50ths of a millimetre.

**English and Metric Measure.** Graduated to read on one side from 1 1-8'' to 10'' by thousandths of an inch, and on the other, from 28 m/m to 25 c/m by 50ths of a millimetre. Both these measurements are outside the jaws.

### 18'' Height Gauge

Price, in Wooden Case, \$95.00

Price, without Case . . . 90.00

Furnished in Case unless otherwise ordered.

**English Measure.** Graduated on one side only to read from 1 1-2'' to 18'' by thousandths of an inch.

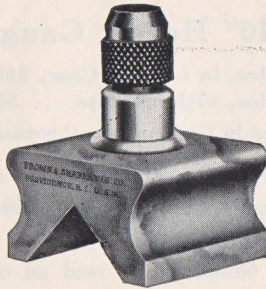
**Metric Measure.** Graduated on one side only to read from 40 m/m to 46 c/m by 50ths of a millimetre.

**English and Metric Measure.** Graduated to read on one side from 1 1-2'' to 18'' by thousandths of an inch, and on the other, from 40 m/m to 46 c/m by 50ths of a millimetre.

Each of the above packed one in a box.



## Height Gauge Attachment No. 598



For Use with Inside Micrometers Nos. 260 and 261

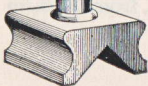
Price, \$2.25



The base shown above is designed for use in connection with Inside Micrometers Nos. 260 and 261, and makes a reliable Micrometer Height Gauge.

The measuring rod is inserted through the underside of the base and the angular grooves on the rods allow the clamping fingers of the attachment to spring in place. By turning the knurled nut the rod is firmly held in an upright position. The micrometer is then adjusted and clamped to the upper end of the rod.

The base has a V-shaped groove in the bottom, which adapts the tool for use in cylindrical work.



Packed one in a box.

# Vernier Depth Gauge No. 600

## ENGLISH, METRIC, OR ENGLISH AND METRIC MEASURE

Gauge with 6" blade

Price { In Leather Case, \$16.25  
Without Case, 14.50 }

Gauge with 6" and 12" blades

Price { In Leather Case, \$24.55  
Without Case, 22.30 }

Furnished in case unless otherwise ordered.

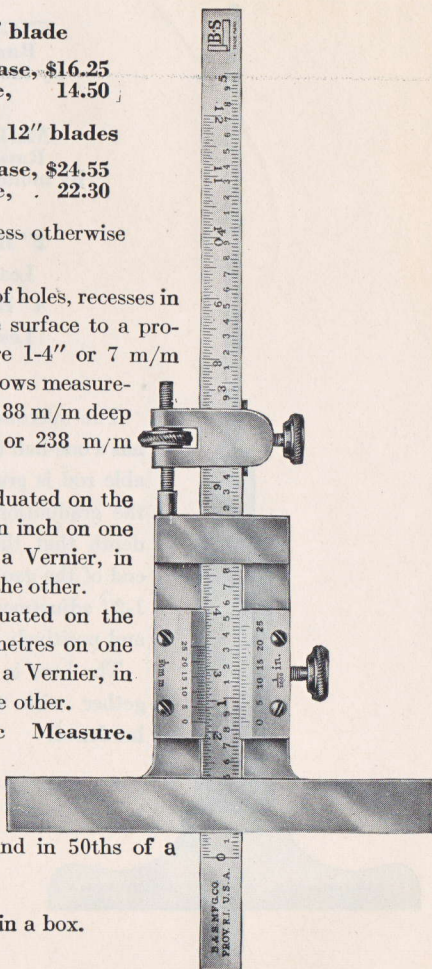
For obtaining the depth of holes, recesses in dies, distance from a plane surface to a projection, etc. The blades are 1-4" or 7 m/m wide. The six-inch blade allows measurements to be made 3 1-2" or 88 m/m deep and the 12" blade 9 1-2" or 238 m/m deep.

**English Measure.** Graduated on the front to read in 64ths of an inch on one corner, and, by means of a Vernier, in thousandths of an inch on the other.

**Metric Measure.** Graduated on the front to read in half-millimetres on one corner, and, by means of a Vernier, in 50ths of a millimetre on the other.

**English and Metric Measure.** Graduated on the front to read, by means of a Vernier, in thousandths of an inch on one corner, and in 50ths of a millimetre on the other.

Packed one in a box.



# Micrometer Depth Gauge No. 605

## ENGLISH MEASURE

Range, 0 to 2 1-2"  
by thousandths of an inch

## METRIC MEASURE

Range, 0 to 63 mm  
by hundredths of a millimetre

2" Base, Price, \$8.75

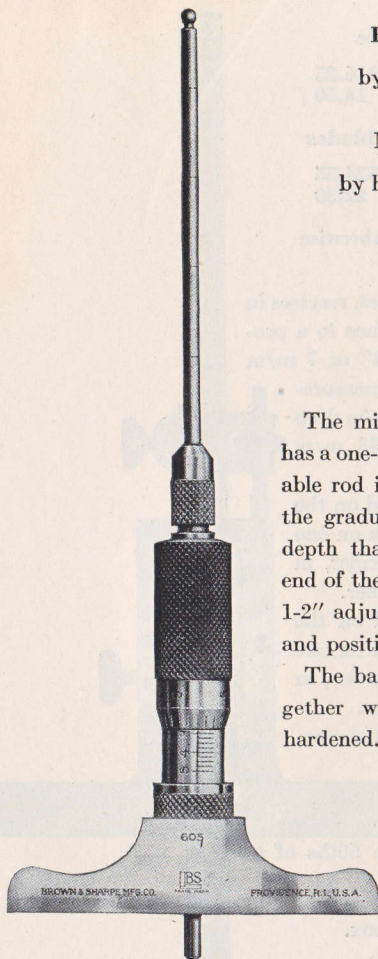
Leather Case, \$1.25

4" Base, Price, \$9.50

Leather Case, \$2.00

The micrometer screw in these gauges has a one-half inch movement. The adjustable rod is graduated each half inch and the graduations are of such a form and depth that the clamping fingers, at the end of the gauge, spring in, and allow the 1-2" adjustment of the rod to be quickly and positively made.

The base is about 7-16" thick and together with the point of the rod, is hardened.



Packed one in a box.



# Micrometer Depth Gauge No. 607

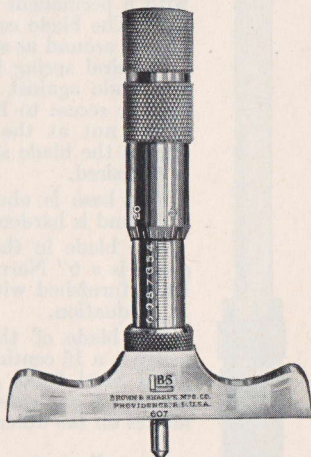
**ENGLISH MEASURE**      or      **METRIC MEASURE**  
 Range, 0 to 3"      Range, 0 to 75 m/m  
 by thousandths of an inch      by hundredths of a millimetre

**2 1-2" Base**

**Price, \$9.00; With Ratchet Stop, \$9.50; Leather Case, \$1.80**

**4" Base**

**Price, \$11.50; With Ratchet Stop, \$12.00; Leather Case, \$2.20**



Micrometer Depth Gauge No. 607 is a serviceable and dependable tool of a design which makes it at once practical and desirable.

The Micrometer Screw has a movement of 1" and the range from 0 to 3" is obtained by the use of the three measuring rods furnished. The rod desired is easily and quickly inserted in the Gauge through a hole in the Micrometer Screw.

The rods measure from 0 to 1", 1" to 2" and 2" to 3", English Measure, or 0 to 25 m/m, 25 m/m to 50 m/m and 50 m/m to 75 m/m Metric Measure.

**Packed one in a box.**

# Universal Depth Gauge No. 610

**ENGLISH MEASURE**  
Range, 0 to 3 1-8"

or

**METRIC MEASURE**  
Range, 0 to 95 mm

**Price, \$5.00**

This depth gauge is especially handy to toolmakers and diemakers for getting depths in places where a gauge with a permanent blade could not be used. The blade can be swiveled completely around as shown below.

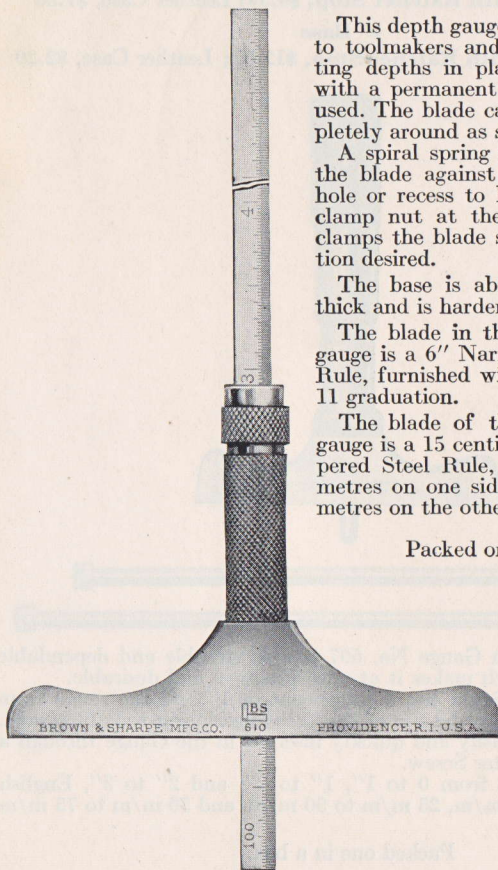
A spiral spring in the barrel forces the blade against the bottom of the hole or recess to be measured, and a clamp nut at the top of the barrel clamps the blade securely in the position desired.

The base is about 3" wide, 7-16" thick and is hardened and ground.

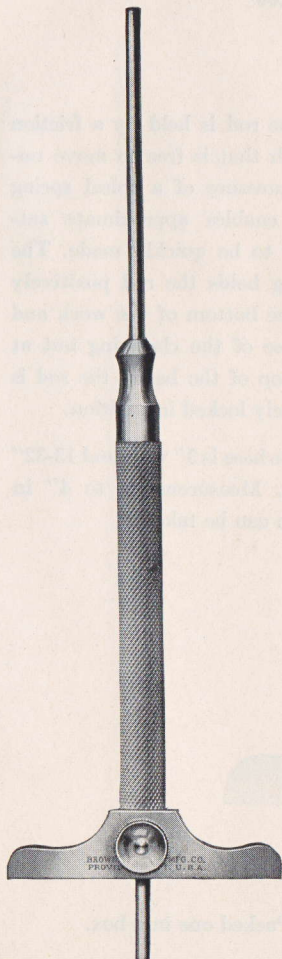
The blade in the English Measure gauge is a 6" Narrow Tempered Steel Rule, furnished with either No. 10 or 11 graduation.

The blade of the Metric Measure gauge is a 15 centimetre Narrow Tempered Steel Rule, graduated in millimetres on one side, and in half millimetres on the other.

Packed one in a box.



## Spring Depth Gauge No. 612



2" Base      Price, \$4.00

4" Base      Price, \$5.00

A spiral spring in the barrel forces the rod against the bottom of the hole or recess to be measured. This spring holds the rod positively on the bottom of the work and, by use of the clamp screw, the rod is securely locked in position.

The base is about 7-16" wide, and the rod about 1-8" in diameter, both the base and lower end of the rod being hardened.

Measures to 3" in depth.

Packed one in a box.

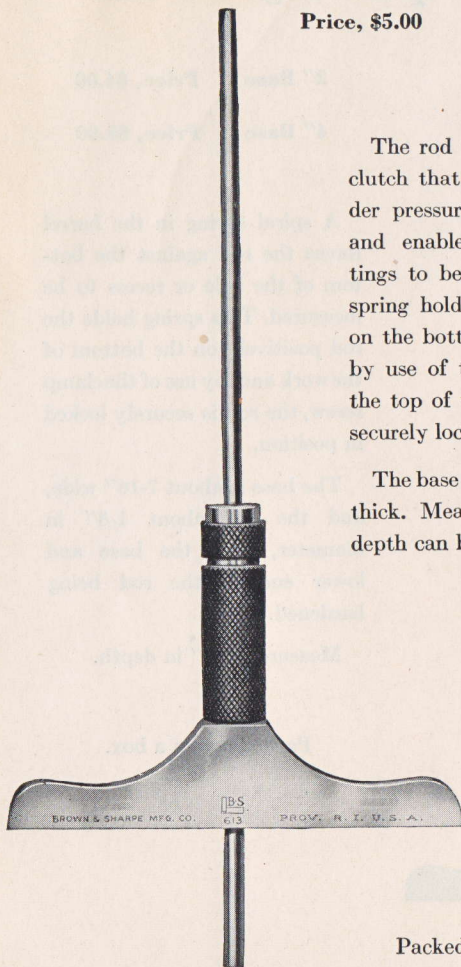


## Spring Depth Gauge No. 613

Price, \$5.00

The rod is held by a friction clutch that is free to move under pressure of a spiral spring and enables approximate settings to be quickly made. The spring holds the rod positively on the bottom of the work and by use of the clamping nut at the top of the barrel the rod is securely locked in position.

The base is 3" wide and 13-32" thick. Measurements to 4" in depth can be taken.



Packed one in a box.

## 6 In. Rule Depth Gauge No. 615

### ENGLISH MEASURE

Range, 0 to 4 1-2"

### METRIC MEASURE

Range, 0 to 113 mm

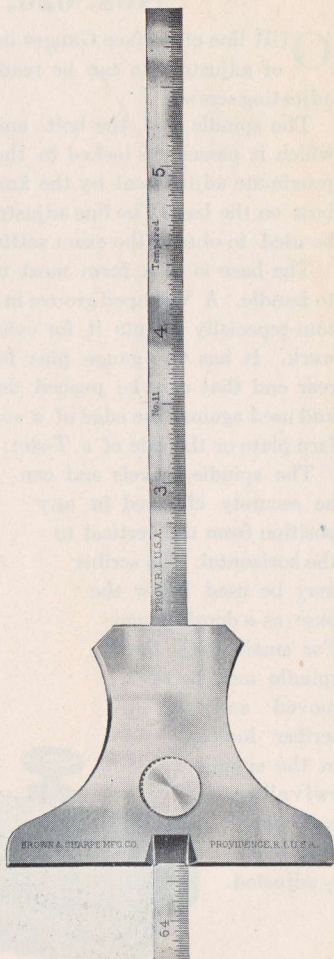
Price, \$1.50

The head of this 6" Rule Depth gauge is made of hardened steel, 2" wide and 1-8" thick, and is of a form especially designed for convenience in measuring.

The blade of the English Measure gauge is a 6" Narrow Tempered Steel Rule and can be furnished with either No. 10 or 11 Graduation.

The blade of the Metric Measure gauge is a 15 cm Narrow Tempered Steel Rule graduated in millimetres on one side and half-millimetres on the other.

Packed one in a box.



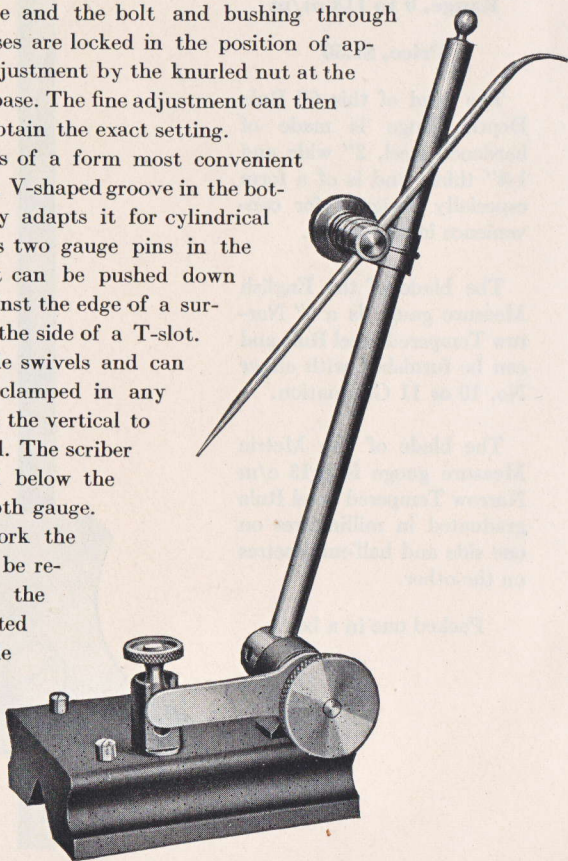
## Universal Surface Gauges Nos. 620, 621 and 622

OUR line of Surface Gauges has been so designed that a wide range of adjustments can be readily made by means of the knurled adjusting screw.

The spindle and the bolt and bushing through which it passes are locked in the position of approximate adjustment by the knurled nut at the boss on the base. The fine adjustment can then be used to obtain the exact setting.

The base is of a form most convenient to handle. A V-shaped groove in the bottom especially adapts it for cylindrical work. It has two gauge pins in the rear end that can be pushed down and used against the edge of a surface plate or the side of a T-slot.

The spindle swivels and can be securely clamped in any position from the vertical to the horizontal. The scriber may be used below the base as a depth gauge. For small work the spindle may be removed and the scriber inserted in the spindle swiveling bolt where it is readily adjusted.





## Universal Surface Gauges No. 620

No.	Price
620A With 4" Spindle, Base Not Hardened.....	\$3.50
620B With 4" Spindle, Base Hardened.....	4.10
Size of Base, 2 1-4" x 1 1-2"	

## Universal Surface Gauges No. 621

No.	Price
621A With 9" Spindle, Base Not Hardened.....	\$3.50
621B With 9" and 12" Spindles, Base Not Hardened.....	4.00
621C With 9" Spindle, Base Hardened.....	4.75
621D With 9" and 12" Spindles, Base Hardened.....	5.25
Size of Base, 3 1-3" x 2 1-2"	

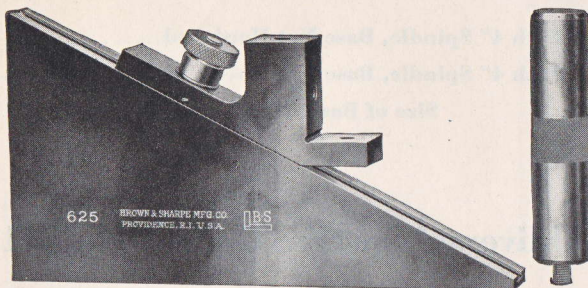
## Universal Surface Gauges No. 622

### Heavy Base

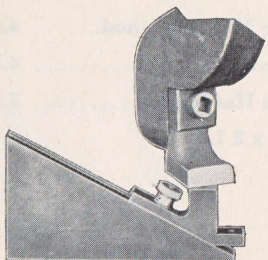
No.	Price
622A With 12" Spindle, Base Not Hardened.....	\$4.15
622B With 12" and 18" Spindles, Base Not Hardened.....	4.75
622C With 12" Spindle, Base Hardened.....	5.40
622D With 12" and 18" Spindles, Base Hardened.....	6.00
Size of Base, 4" x 3 3-8"	

Each of the above packed one in a box.

## Planer and Shaper Gauge No. 625



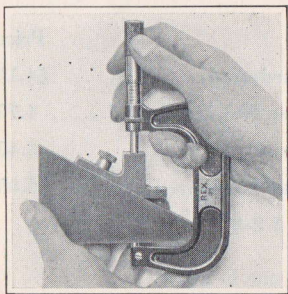
Price, \$4.50



With this gauge the time spent by the planer hand in adjusting the cutting tool is reduced to a minimum. By setting this gauge to a micrometer, surface gauge or caliper and bringing the planer tool in contact with it, the first cut may be relied upon to give the desired dimension.

The slide is so designed that with one extension it is possible to get a tool setting from  $\frac{1}{4}$ " to  $3\frac{1}{2}$ ". The base, slide and extension are made of high quality steel and hardened and ground.

Packed one in a box.



## Screw Pitch Gauge No. 630

**"V" Threads**  
**22 Pitches, 9 to 40**  
**Including Pipe**  
**Thread Pitches**



**Price, \$1.25**

The shape of the blades of Brown & Sharpe Screw Pitch Gauges adapts them for the threads of nuts as well as of screws. The arrangement of blades, hinged on each end of the case, enables the mechanic to quickly select the desired blade and place it in position for use. The number of threads per inch and double the depth of thread in decimals are stamped on each blade.

Gauge No. 630 contains the following threads per inch: 9, 10, 11, 11 1-2, 12, 13, 14, 15, 16, 18 and 20 on one end and 22, 24, 26, 27, 28, 30, 32, 34, 36, 38 and 40 on the other.

There are 22 pitches, including pipe thread, threads per inch, 11 1-2 and 27. 8 pitch can be determined by using the 16 pitch blade.

## Screw Pitch Gauge No. 631

**"V" Threads**

**24 Pitches, 4 to 30**

**Price, \$1.50**

Similar in design to Screw Pitch Gauge No. 630. It contains 24 blades with the following threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2 and 12 on one end and 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28 and 30 on the other.

## Screw Pitch Gauge No. 632

**"V" Threads**

**30 Pitches, 4 to 42**

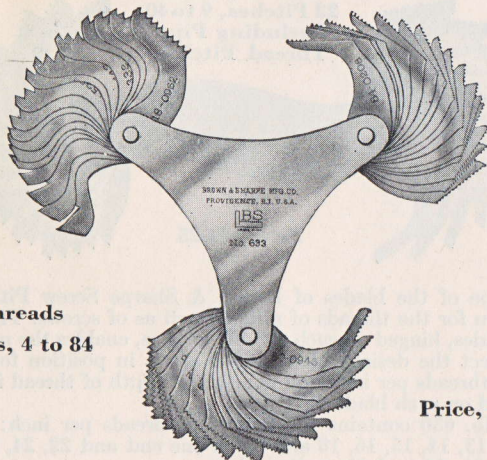
**Price, \$1.75**

Similar in design to Screw Pitch Gauge No. 630. It contains 30 blades with the following threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2, 12, 13, 14 and 15 on one end and 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40 and 42 on the other.

Each of the above packed one in a box; twelve boxes in a carton.



## Screw Pitch Gauge No. 633



### "V" Threads

51 Pitches, 4 to 84

Price, \$2.75

For the mechanic who has use for a gauge with a great variety of pitches this gauge is just the tool. The triangular shape of the frame permits the compact housing of 51 blades, suitable for checking the threads of nuts as well as screws.

It is easy to use and the blades can be quickly selected as the different pitches of each group of blades are stamped on the outside of the frame.

This gauge covers all pitches of V threads, including pipe threads, threads per inch, 11 1-2 and 27. 8 pitch can be determined by using the 16 pitch blade. The number of threads per inch and the double depth of threads in decimals are stamped on each blade.

This gauge contains the following threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82 and 84.

Formula for V thread:

$$d = D - \frac{1.733}{N}$$

D = Outside diameter of tap

d = Bottom " " "

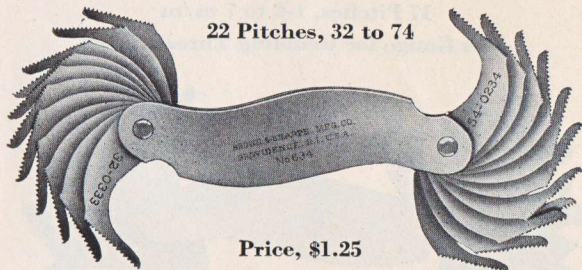
N = Number of threads per inch

Packed one in a box; twelve boxes in a carton.

## Screw Pitch Gauge No. 634

"V" Threads

22 Pitches, 32 to 74



Price, \$1.25

Screw Pitch Gauge No. 634 is especially designed for those who require a gauge for determining the number of threads per inch of screws with fine threads. The number of threads per inch and the double depth of the thread in decimals are stamped on each blade.

It contains blades, with the following threads per inch: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50 and 52 on one end, and 54, 56, 58, 60, 62, 64, 66, 68, 70, 72 and 74 on the other.

## Screw Pitch Gauge No. 635

U. S. Standard Threads

25 Pitches, 2 1-4 to 20

Price, \$2.00

Has Gauge for Grinding Thread Tools

This gauge is similar in design to No. 634, shown above, but is without decimals stamped on the blades.

It contains 26 blades, with the following threads per inch: 2 1-4, 2 3-8, 2 1-2, 2 5-8, 2 3-4, 2 7-8, 3, 3 1-4, 3 1-2, 4, 4 1-2 and 5 on one end, and 5 1-2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18 and 20 on the other.

Formula for U. S. Standard thread:

$$d = D - \frac{1.299}{N}$$

D Outside diameter of tap.

d Bottom " " "

N Number of threads per inch.

Each of the above packed one in a box; twelve boxes in a carton.

## Screw Pitch Gauge No. 636

Système International

17 Pitches, 1-2 to 7 m/m

Has Gauge for Grinding Thread Tools



Price, \$1.25

For determining the pitch of screws, nuts, bolts, etc., and is made after the French system of the Society of Encouragement for National Industry. It can be used for inside as well as outside threads. The gauge contains blades for the following pitches: 1-2, 3-4, 1, 1 1-4, 1 1-2, 1 3-4, 2, 2 1-2, 3, 3 1-2, 4, 4 1-2, 5, 5 1-2, 6, 6 1-2 and 7 millimetres.

## Screw Pitch Gauge No. 637

Whitworth Standard

24 Pitches, 4 to 48

Price, \$1.50

Similar in design to gauge shown above, but without decimals. Contains 24 blades, with the following threads per inch: 4, 4 1-2, 5, 6, 7, 8, 9, 10, 11, 12, 14 and 16 on one end; 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 40 and 48 on the other.

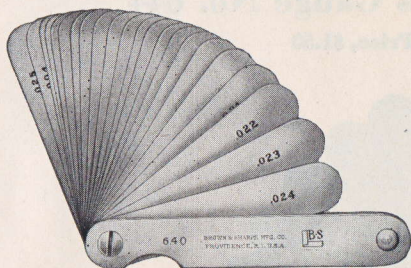
Each of the above packed one in a box; twelve boxes in a carton.



## Thickness Gauge No. 640

Price, \$2.50

Has 22 ground blades varying in thickness from .004" to .025", inclusive, by thousandths of an inch. The blades are 2 5-16" long and 7-16" wide.

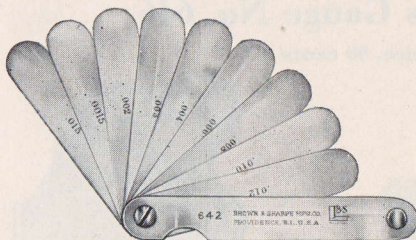


## Thickness Gauge No. 641

METRIC MEASURE

Price, \$2.50

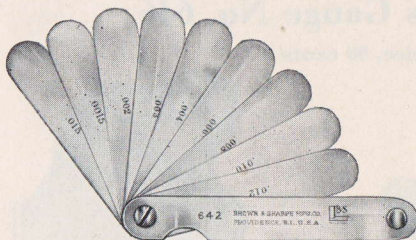
Has 14 blades ground to the following thicknesses: .05, .06, .07, .08, .09, .10, .15, .20, .25, .30, .40, .50, .75, and 1 m/m.



## Thickness Gauge No. 642

Price, \$1.50

Has 9 blades ground to the following thicknesses: .0015, .002, .003, .004, .006, .008, .010, .012, and .015 of an inch in thickness.



## Thickness Gauge No. 643

METRIC MEASURE

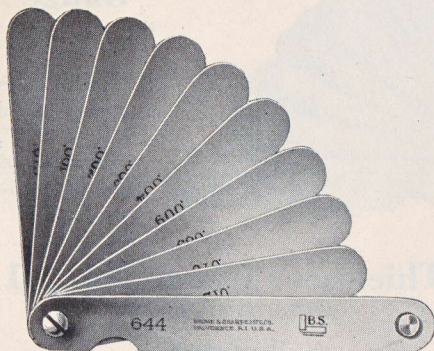
Price, \$1.50

Has 9 blades ground to the following thicknesses: .04, .05, .08, .10, .15, .20, .25, .30, and .35 m/m.

Each of the above packed one in a box; twelve boxes in a carton.

## Thickness Gauge No. 644

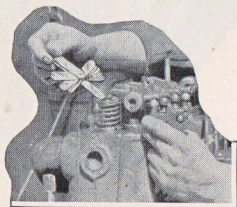
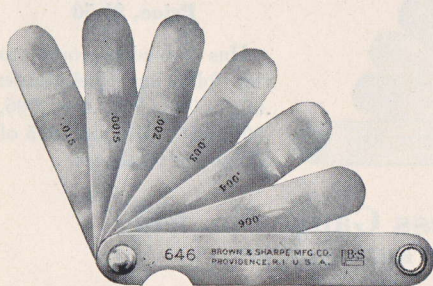
Price, \$1.50



This gauge has 9 blades, 3" long and 1-2" wide, of the following thicknesses: .0015, .002, .003, .004, .006, .008, .010, .012 and .015 of an inch.

## Thickness Gauge No. 646

Price, 90 cents

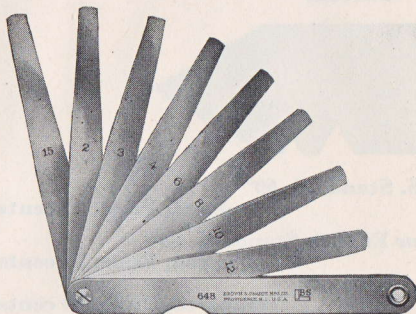


Especially designed for the garage mechanic, car owner, and truck or tractor operator. It has 6 blades, 2 5-16" long and 7-16" wide, ground to the following thicknesses: .0015, .002, .003, .004, .006 and .015 of an inch.

Each of the above packed one in a box; twelve boxes in a carton.

## Thickness Gauge No. 648

Price, \$2.50



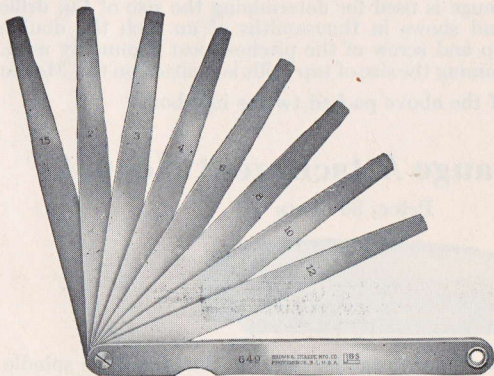
This gauge contains 8 tapered blades, tempered and accurately ground to size. The blades are 4 1-2" long and 1-2" wide at the heel. The taper on the end of the blade is 2 3-4" long and narrows down to 1-4" in width on the end.

The blades are of the following thicknesses:

.002", .003", .004", .006", .008", .010", .012" and .015".

## Thickness Gauge No. 649

Price, \$3.00



The blades of this gauge are 6" long, 1-2" wide at the heel and taper on the end for 2 3-4" down to 1-4" wide on the end. The length of the blades in this gauge makes it particularly useful to the Motor Service Mechanic for finding the clearance between pistons and cylinder walls.

There are 8 blades tempered and accurately ground to the following thicknesses: .002", .003", .004", .006", .008", .010", .012" and .015".

Each of the above packed one in a box; twelve boxes in a carton.



## Center Gauges Nos. 650, 651 and 652

With Table for Determining the Size of Tap Drills for 60° V Threads



U. S. Standard, 60°

No. 650, Price, 40 cents

Tempered, Price, 50 cents

Whitworth or English Standard, 55°

No. 651, Price, 40 cents

Tempered, Price, 50 cents

Metric, 60°

No. 652, Price, 40 cents

Tempered, Price, 50 cents

The angles used on these gauges are 60° for the U. S. Std. and Metric Gauges, and 55° for the Whitworth or English Standard. The four divisions, 14, 20, 24 and 32 parts to the inch, are useful in measuring the number of threads to the inch.

The Metric Gauge is graduated to read in millimetres and half millimetres.

The table on the gauge is used for determining the size of tap drills for 60° V threads, and shows in thousandths of an inch the double depth of thread of tap and screw of the pitches most commonly used.

The table for determining the size of tap drills is omitted on the Metric Gauge.

Each of the above packed twelve in a box.

## Center Gauge Attachment No. 654

Price, 50 cents



The attachment holds the center gauge firmly against the lathe spindle or face plate, aiding in setting the cutting tool to the proper angle.

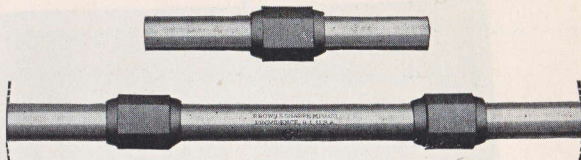
The base of the attachment has a V groove and in the top there is a slot, containing a flat spring which holds the center gauge. It can be used for setting both internal and external screw cutting tools.

Packed three in a box.

# Standard End Measuring Rods

## Nos. 655 and 656

### With Spherical Ends



These rods are made of high-grade steel, hardened on the ends and accurately ground so that the ends are sections of true spheres having diameters equal to those of the length of the rods. They are especially useful for measuring parallel surfaces, rings, cylinders, etc., setting calipers, comparing gauges, and testing precision measuring tools.

The rubber grips make the rods much more convenient to handle, as they resist the heat and moisture of the hand and prevent the rods from slipping while in use. The 3", 4" and 5" rods are furnished with one rubber grip, and the 6" and over have two grips.

### No. 655, English

Length, Inches	Diam., Inches	Price	Length, Inches	Diam., Inches	Price
3	3-8	\$1.75	10	1-2	\$3.50
4	3-8	2.00	11	1-2	3.75
5	3-8	2.25	12	1 2	4.00
6	1-2	2.50	13	1-2	4.25
7	1-2	2.75	14	1-2	4.50
8	1-2	3.00	15	1 2	4.75
9	1-2	3.25	16	1-2	5.00

All intermediate sizes, varying by 16ths, are carried in stock and will be furnished at the price of the next larger size given in the list.

### No. 656, Metric

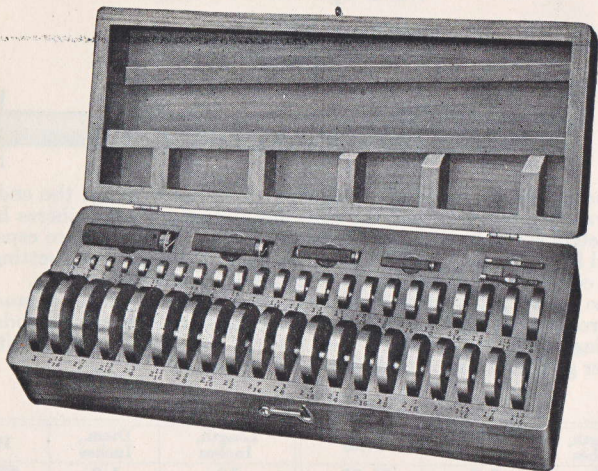
Length, m/m	Diam., m/m	Price	Length, m/m	Diam., m/m	Price
75	10	\$1.75	250	13	\$3.50
100	10	2.00	275	13	3.75
125	10	2.25	300	13	4.00
150	13	2.50	325	13	4.25
175	13	2.75	350	13	4.50
200	13	3.00	375	13	4.75
225	13	3.25	400	13	5.00

Each of the above packed one in a package.



## Standard Reference Disks

### Nos. 657 and 658



These disks are made of high-grade steel, hardened, ground and accurately lapped to size. They are for reference sizes in shop practice, and for testing a gauge or caliper which has been long in use to find whether or not the wear of constant use has impaired its accuracy.

Handles are furnished which screw into the center of the disks and make them convenient to use for internal testing. However, using the disks as cylindrical gauges is not recommended as they are designed to serve principally as reference gauges and not working gauges.

The measuring surfaces are suitably proportioned according to the diameter of the disk.

Reference disks are carried in stock as listed on the following page, in English and Metric Measure, in sizes as follows:

**English Measure**, sizes from 1-4" to 3", varying by 16ths.

**Metric Measure**, sizes from 6 m/m to 50 m/m, varying by 2 m/m; and from 55 m/m to 100 m/m, varying by 5 m/m.

**Special Sizes** made to order.

The **English Measure** gauges are also furnished in sets, neatly arranged in substantial wooden cases and with sizes from 1-4" to 3", varying by 16ths. **Price, per set, \$90.00.**

Packed one set in a box.



## Standard Reference Disks No. 657

### English

Size, Inches	Price	Size, Inches	Price	Size, Inches	Price
*1-4	\$1.50	1 3-16	\$1.30	2 1-8	\$2.25
*5-16	1.50	1 1-4	1.30	2 3-16	2.25
3-8	1.00	1 5-16	1.50	2 1-4	2.25
7-16	1.00	1 3-8	1.50	2 5-16	2.50
1-2	1.10	1 7-16	1.50	2 3-8	2.50
9-16	1.10	1 1-2	1.50	2 7-16	2.50
5-8	1.10	1 9-16	1.70	2 1-2	2.50
11-16	1.10	1 5-8	1.70	2 9-16	2.50
3-4	1.20	1 11-16	1.70	2 5-8	2.50
13-16	1.20	1 3-4	1.70	2 11-16	2.50
7-8	1.20	1 13-16	2.00	2 3-4	2.75
15-16	1.20	1 7-8	2.00	2 13-16	2.75
1	1.30	1 15-16	2.00	2 7-8	2.75
1 1-16	1.30	2	2.00	2 15-16	2.75
1 1-8	1.30	2 1-16	2.25	3	2.75

## Standard Reference Disks No. 658

### Metric

Size, m/m	Price	Size, m/m	Price	Size, m/m	Price
*6	\$1.50	28	\$1.30	50	\$2.00
*8	1.50	30	1.30	55	2.25
10	1.00	32	1.30	60	2.50
12	1.10	34	1.50	65	2.50
14	1.10	36	1.50	70	2.75
16	1.10	38	1.50	75	2.75
18	1.10	40	1.70	80	3.00
20	1.20	42	1.70	85	3.00
22	1.20	44	1.70	90	3.00
24	1.20	46	2.00	95	3.25
26	1.30	48	2.00	100	3.25

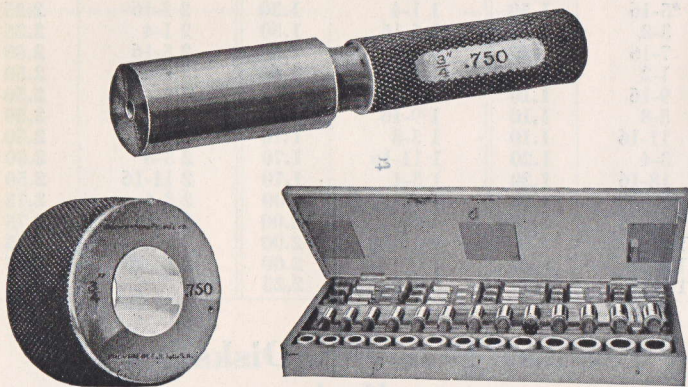
\*These sizes are furnished with handles.

#### Price of Handles

For 3-8" to 9-16" or 10 m/m to 14 m/m Disks.....	\$0.65
For 5-8" to 1 1-16" or 16 m/m to 26 m/m Disks.....	.75
For 1 1-8" to 1 3-4" or 28 m/m to 44 m/m Disks.....	.80
For 1 13-16" to 3" or 46 m/m to 75 m/m Disks.....	.90
For 80 m/m to 100 m/m Disks.....	.90

Each of the above packed one in a package.

## Standard Internal and External Cylindrical Gauges Nos. 660, 661, 662 and 663.



These gauges have exceptionally large measuring surfaces and are recommended for the most accurate work. Each gauge is plainly stamped with its size, both in decimals and common fractions; and a rigid inspection is exacted before gauges are prepared for shipment.

The Internal Gauges or "Plugs" are convenient for machine work for measuring work internally as they can be employed directly. The large sizes are unusually light in proportion to their size. They consist of a hardened steel ring on an aluminum center; and while this construction makes the gauges very light and convenient, it does not in any way impair their accuracy.

The External Gauges or "Rings" can be used direct for measuring shafts, spindles, and work of a similar class.

Internal and External Cylindrical Gauges are carried in stock, as listed on the following pages, in English and Metric Measure, in sizes, as follows:

**English Measure**, in sizes from 1-4" to 2", varying by 16ths of an inch.

**Metric Measure**, in sizes from 5 m/m to 50 m/m varying by 1 m/m; and from 55 m/m to 100 m/m, varying by 5 m/m.

The **English Measure** Gauges, Internal and External, are also furnished in sets arranged in substantial wooden cases with sizes from 1-4" to 2", varying by 16ths of an inch, **price per set \$443.00.**

# Standard Internal Cylindrical Gauges

## No. 660

### ENGLISH

Size, Inches	Price	Size, Inches	Price	Size, Inches	Price
1-8	\$3.75	1 1-8	\$5.40	2 1-8	\$8.95
3-16	3.75	1 3-16	5.50	2 3-16	9.15
1-4	3.75	1 1-4	5.65	2 1-4	9.30
5-16	3.75	1 5-16	5.80	2 5-16	9.50
3-8	3.90	1 3-8	6.00	2 3-8	9.80
7-16	4.00	1 7-16	6.20	2 7-16	10.15
1-2	4.15	1 1-2	6.40	2 1-2	10.30
9-16	4.25	1 9-16	6.55	2 9-16	10.50
5-8	4.40	1 5-8	6.75	2 5-8	10.70
11-16	4.50	1 11-16	6.95	2 11-16	10.90
3-4	4.65	1 3-4	7.15	2 3-4	11.05
13-16	4.75	1 13-16	7.35	2 13-16	11.25
7-8	4.90	1 7-8	7.50	2 7-8	11.45
15-16	5.00	1 15-16	7.70	2 15-16	11.65
1	5.15	2	7.90	3	11.80
1 1-16	5.25	2 1-16	8.75	.....	.....

# Standard Internal Cylindrical Gauges

## No. 661

### METRIC

Size, m/m	Price	Size, m/m	Price	Size, m/m	Price	Size, m/m	Price
5	\$3.75	23	\$5.00	41	\$6.75	59	\$9.50
6	3.75	24	5.00	42	6.95	60	9.80
7	3.75	25	5.15	43	6.95	61	10.15
8	3.75	26	5.25	44	7.15	62	10.15
9	3.90	27	5.25	45	7.15	63	10.30
10	3.90	28	5.40	46	7.35	64	10.30
11	4.00	29	5.40	47	7.50	65	10.50
12	4.15	30	5.50	48	7.50	66	10.70
13	4.15	31	5.65	49	7.70	67	10.70
14	4.25	32	5.65	50	7.90	68	10.90
15	4.40	33	5.80	51	7.90	69	11.05
16	4.40	34	6.00	52	8.75	70	11.05
17	4.50	35	6.00	53	8.75	71	11.25
18	4.50	36	6.20	54	8.95	72	11.25
19	4.65	37	6.20	55	9.15	73	11.45
20	4.75	38	6.40	56	9.15	74	11.65
21	4.75	39	6.55	57	9.30	75	11.65
22	4.90	40	6.55	58	9.50	..	.....



# Standard External Cylindrical Gauges

## No. 662

### ENGLISH

Size, Inches	Price	Size, Inches	Price	Size, Inches	Price
1-8	\$5.55	1 1-8	\$8.45	2 1-8	\$14.05
3-16	5.55	1 3-16	8.75	2 3-16	14.40
1-4	5.55	1 1-4	9.05	2 1-4	14.70
5-16	5.75	1 5-16	9.40	2 5-16	15.00
3-8	5.95	1 3-8	9.70	2 3-8	15.30
7-16	6.15	1 7-16	10.00	2 7-16	15.65
1-2	6.30	1 1-2	10.30	2 1-2	15.95
9-16	6.50	1 9-16	10.65	2 9-16	16.25
5-8	6.70	1 5-8	10.95	2 5-8	16.55
11-16	6.90	1 11-16	11.25	2 11-16	16.90
3-4	7.05	1 3-4	11.55	2 3-4	17.20
13-16	7.25	1 13-16	11.90	2 13-16	17.50
7-8	7.45	1 7-8	12.20	2 7-8	17.80
15-16	7.65	1 15-16	12.50	2 15-16	18.15
1	7.80	2	12.80	3	18.45
1 1-16	8.15	2 1-16	13.75	....	....

# Standard External Cylindrical Gauges

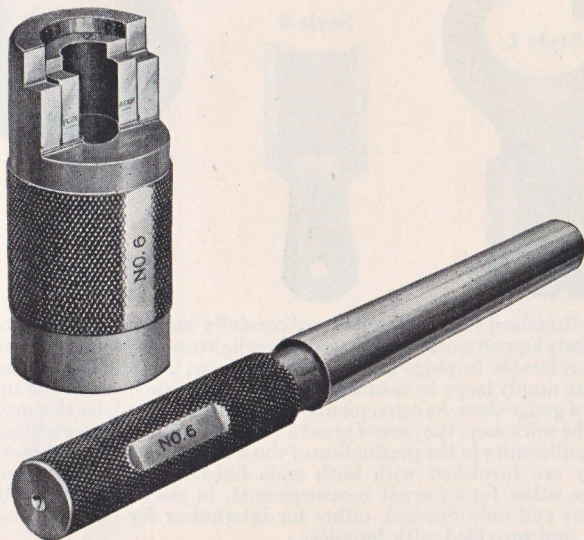
## No. 663

### METRIC

Size, m/m	Price	Size, m/m	Price	Size, m/m	Price	Size, m/m	Price
5	\$5.55	23	\$7.65	41	\$10.95	59	\$15.00
6	5.55	24	7.65	42	11.25	60	15.30
7	5.75	25	7.80	43	11.25	61	15.65
8	5.75	26	8.15	44	11.55	62	15.65
9	5.95	27	8.15	45	11.55	63	15.95
10	5.95	28	8.45	46	11.90	64	15.95
11	6.15	29	8.45	47	12.20	65	16.25
12	6.30	30	8.75	48	12.20	66	16.55
13	6.30	31	9.05	49	12.50	67	16.55
14	6.50	32	9.05	50	12.80	68	16.90
15	6.70	33	9.40	51	12.80	69	17.20
16	6.70	34	9.70	52	13.75	70	17.20
17	6.90	35	9.70	53	13.75	71	17.50
18	6.90	36	10.00	54	14.05	72	17.50
19	7.05	37	10.00	55	14.40	73	17.80
20	7.25	38	10.30	56	14.40	74	18.15
21	7.25	39	10.65	57	14.70	75	18.15
22	7.45	40	10.65	58	15.00	..	....

## Standard Taper Cylindrical Gauges

### Internal and External



For maintaining standard taper holes in the spindles of machines, collets, etc., as well as standard shanks of arbors, collets, end mills, drills, and tools of a similar character; and are also of service in the sizing of standard taper reamers. These gauges are made in the most careful manner, are hardened, accurately ground and lapped to size. The measuring surfaces are long in proportion to the size of the gauge, thus insuring the maintenance of gauge sizes.

The small ends of the external gauges have adjustable, hardened blocks for indicating the plug depth and reamer depth; one side is plainly stamped "Plug" and the other "Reamer."

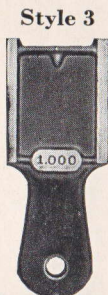
**Prices on application.**

## Standard Caliper Gauges

### Nos. 665, 666, 667, 668, 669 and 670



Style 1



Style 3



Style 2

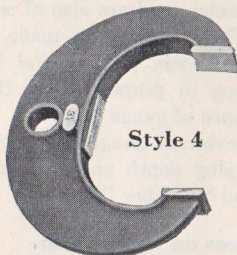
The Standard Caliper Gauges are carefully hardened and ground and accurately lapped to size. Their form gives lightness and strength, making them preferable to plugs and rings for frequent use. The measuring surfaces are amply large to insure accurate measurements and the maintenance of gauge sizes. As convenient and reliable standard sizes for everyday use in the workshop, they are of great advantage, and their use will contribute to uniformity in the production of the working parts of machinery.

They are furnished with both ends finished, one end for internal and the other for external measurements, in sizes to three inches, or with one end only finished, either for internal or for external measurements, and provided with handles.

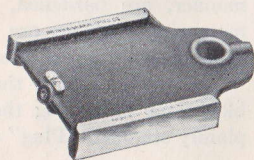
Style 1 is furnished in sets, comprising sizes from 1-4" to 2 1-2" inclusive, varying by 16ths to 2" and above 2" by 8ths. Each set is furnished in a Substantial Wooden Case. Price per Set, \$140.00.

For convenience in handling, the Standard Caliper Gauges in the larger sizes are made as shown at right.

For List of Caliper Gauges, see following pages.



Style 4



Style 5



# Standard Caliper Gauges No. 665

BOTH ENDS FINISHED

English — Style 1

Size, Inches	Price, Each	Size, Inches	Price, Each	Size, Inches	Price, Each
1-4	\$3.50	1 3-16	\$4.00	2 1-8	\$5.60
5-16	3.50	1 1-4	4.05	2 3-16	5.75
3-8	3.50	1 5-16	4.15	2 1-4	5.90
7-16	3.50	1 3-8	4.20	2 5-16	6.00
1-2	3.50	1 7-16	4.25	2 3-8	6.15
9-16	3.50	1 1-2	4.35	2 7-16	6.30
5-8	3.50	1 9-16	4.50	2 1-2	6.45
11-16	3.50	1 5-8	4.60	2 9-16	7.00
3-4	3.50	1 11-16	4.75	2 5-8	7.35
13-16	3.55	1 3-4	4.90	2 11-16	7.70
7-8	3.65	1 13-16	5.05	2 3-4	7.70
15-16	3.70	1 7-8	5.20	2 13-16	8.40
1	3.80	1 15-16	5.30	2 7-8	8.40
1 1-16	3.85	2	5.45	2 15-16	8.40
1 1-8	3.90	2 1-16	5.55	3	9.10

# Standard Caliper Gauges No. 666

Metric — Style 1

Size, m/m	Price, Each	Size, m/m	Price, Each	Size, m/m	Price, Each	Size, m/m	Price, Each
5	\$3.50	24	\$3.70	43	\$4.75	62	\$6.30
6	3.50	25	3.80	44	4.90	63	6.45
7	3.50	26	3.85	45	4.90	64	6.45
8	3.50	27	3.85	46	5.05	65	7.00
9	3.50	28	3.90	47	5.20	66	7.35
10	3.50	29	4.00	48	5.20	67	7.35
11	3.50	30	4.00	49	5.30	68	7.70
12	3.50	31	4.05	50	5.45	69	7.70
13	3.50	32	4.05	51	5.45	70	7.70
14	3.50	33	4.15	52	5.55	71	8.40
15	3.50	34	4.20	53	5.55	72	8.40
16	3.50	35	4.20	54	5.60	73	8.40
17	3.50	36	4.25	55	5.75	74	8.40
18	3.50	37	4.25	56	5.75	75	8.40
19	3.50	38	4.35	57	5.90	76	9.20
20	3.55	39	4.50	58	6.00	77	9.20
21	3.55	40	4.50	59	6.00	78	9.20
22	3.65	41	4.60	60	6.15		
23	3.70	42	4.75	61	6.30		

# Standard Caliper Gauges No. 667

## Internal—English

Style 3 up to and including 2 15/16"; the rest are Style 5

Size, Inches	Price, Each	Size, Inches	Price, Each	Size, Inches	Price, Each
1-4	\$1.95	1 7-8	\$2.95	3 1-2	\$4.90
5-16	1.95	1 15-16	2.95	3 9-16	5.25
3-8	1.95	2	3.10	3 5-8	5.25
7-16	1.95	2 1-16	3.10	3 11-16	5.25
1-2	1.95	2 1-8	3.10	3 3-4	5.25
9-16	1.95	2 3-16	3.20	3 13-16	5.60
5-8	1.95	2 1-4	3.20	3 7-8	5.60
11-16	1.95	2 5-16	3.20	3 15-16	5.60
3-4	2.05	2 3-8	3.35	4	5.60
13-16	2.05	2 7-16	3.35	4 1-8	5.95
7-8	2.05	2 1-2	3.50	4 1-4	5.95
15-16	2.05	2 9-16	3.90	4 3-8	5.95
1	2.10	2 5-8	4.05	4 1-2	5.95
1 1-16	2.10	2 11-16	4.20	4 5-8	5.95
1 1-8	2.15	2 3-4	4.20	4 3-4	5.95
1 3-16	2.15	2 13-16	4.60	4 7-8	5.95
1 1-4	2.25	2 7-8	4.60	5	5.95
1 5-16	2.25	2 15-16	4.60	5 1-8	6.30
1 3-8	2.30	3	4.60	5 1-4	6.30
1 7-16	2.30	3 1-16	4.60	5 3-8	6.30
1 1-2	2.40	3 1-8	4.60	5 1-2	6.30
1 9-16	2.45	3 3-16	4.60	5 5-8	6.30
1 5-8	2.50	3 1-4	4.60	5 3-4	6.30
1 11-16	2.65	3 5-16	4.90	5 7-8	6.30
1 3-4	2.80	3 3-8	4.90	6	6.30
1 13-16	2.80	3 7-16	4.90		

Larger sizes made to order. Prices upon application.

# Standard Caliper Gauges No. 668

## Internal—Metric

Style 5

Size, m/m	Price, Each	Size, m/m	Price, Each	Size, m/m	Price, Each	Size, m/m	Price, Each
79	\$4.60	87	\$4.90	95	\$5.25	115	\$5.95
80	4.60	88	4.90	96	5.60	120	5.95
81	4.60	89	5.25	97	5.60	125	5.95
82	4.60	90	5.25	98	5.60	130	6.30
83	4.90	91	5.25	99	5.60	135	6.30
84	4.90	92	5.25	100	5.60	140	6.30
85	4.90	93	5.25	105	5.95	145	6.30
86	4.90	94	5.25	110	5.95	150	6.30

Intermediate sizes, not listed between 100 m/m and 150 m/m, are made to order. Prices upon application.

# Standard Caliper Gauges No. 669

## External—English

Style 2 up to and including 2"; the rest are Style 4.

Size, Inches	Price, Each	Size, Inches	Price, Each	Size, Inches	Price, Each
1-4	\$1.95	1 7-8	\$2.95	3 1-2	\$4.90
5-16	1.95	1 15-16	2.95	3 9-16	5.25
3-8	1.95	2	3.10	3 5-8	5.25
7-16	1.95	2 1-16	3.10	3 11-16	5.25
1-2	1.95	2 1-8	3.10	3 3-4	5.25
9-16	1.95	2 3-16	3.20	3 13-16	5.60
5-8	1.95	2 1-4	3.20	3 7-8	5.60
11-16	1.95	2 5-16	3.20	3 15-16	5.60
3-4	2.05	2 3-8	3.35	4	5.60
13-16	2.05	2 7-16	3.35	4 1-8	5.95
7-8	2.05	2 1-2	3.50	4 1-4	5.95
15-16	2.05	2 9-16	3.90	4 3-8	5.95
1	2.10	2 5-8	4.05	4 1-2	5.95
1 1-16	2.10	2 11-16	4.20	4 5-8	5.95
1 1-8	2.15	2 3-4	4.20	4 3-4	5.95
1 3-16	2.15	2 13-16	4.60	4 7-8	5.95
1 1-4	2.25	2 7-8	4.60	5	5.95
1 5-16	2.25	2 15-16	4.60	5 1-8	6.30
1 3-8	2.30	3	4.60	5 1-4	6.30
1 7-16	2.30	3 1-16	4.60	5 3-8	6.30
1 1-2	2.40	3 1-8	4.60	5 1-2	6.30
1 9-16	2.45	3 3-16	4.60	5 5-8	6.30
1 5-8	2.50	3 1-4	4.60	5 3-4	6.30
1 11-16	2.65	3 5-16	4.90	5 7-8	6.30
1 3-4	2.80	3 3-8	4.90	6	6.30
1 13-16	2.80	3 7-16	4.90		

Larger sizes made to order. Prices upon application.

# Standard Caliper Gauges No. 670

## External—Metric

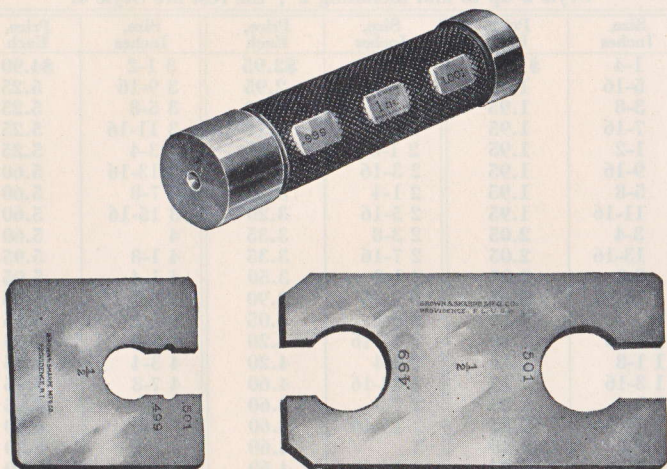
Style 4

Size, m/m	Price, Each	Size, m/m	Price, Each	Size, m/m	Price, Each	Size, m/m	Price, Each
79	\$4.60	87	\$4.90	95	\$5.25	115	\$5.95
80	4.60	88	4.90	96	5.60	120	5.95
81	4.60	89	5.25	97	5.60	125	5.95
82	4.60	90	5.25	98	5.60	130	6.30
83	4.90	91	5.25	99	5.60	135	6.30
84	4.90	92	5.25	100	5.60	140	6.30
85	4.90	93	5.25	105	5.95	145	6.30
86	4.90	94	5.25	110	5.95	150	6.30

Intermediate sizes, not listed between 100 m/m and 150 m/m, made to order.



## Limit Gauges

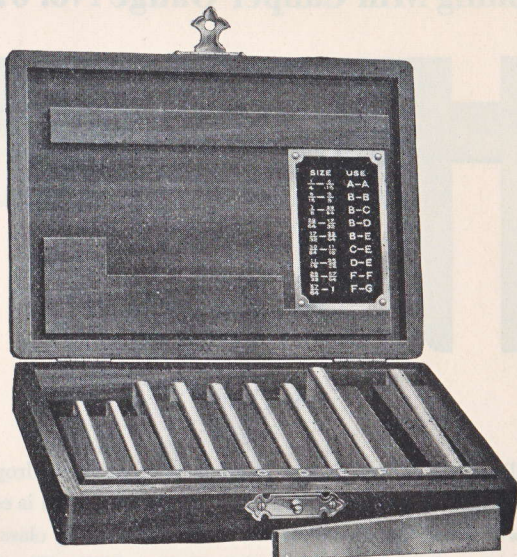


The advantage derived from the use of Limit Gauges is that the time consumed in testing and gauging is reduced to a minimum, and the accurate duplication of parts is insured. The two ends are of different shape, thus furnishing means of identifying the larger end from the smaller without reference to the size stamped on the gauge. Another and very convenient form has both sizes contained between the jaws at one end of the gauge; the large size, or maximum limit, is at the outer end of the jaws, and the small, or minimum limit, at the inner end.

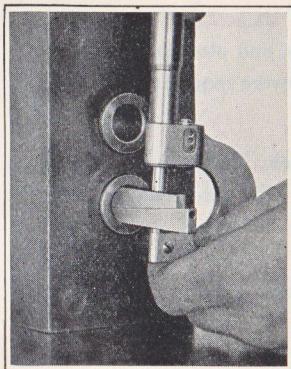
In addition to their value for finishing sizes they are of great advantage in roughing work for finishing, making it much easier to finish to size since the same amount of stock is left on each piece.

Prices are quoted on Limit or Special Gauges of all descriptions when specifications, drawings, or samples of work are sent. The dimensions required at each end of the gauge must be plainly stated in thousandths or fractions of thousandths of an inch.

## Taper Parallel Gauges No. 672



Price, per Set, \$20.00

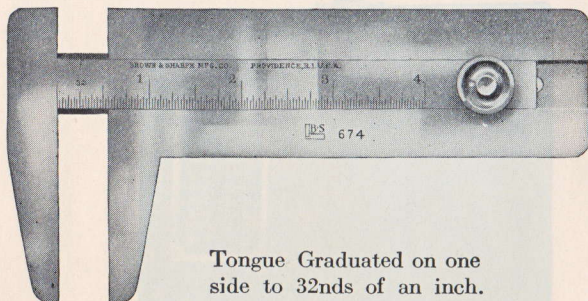


This set consists of 10 gauges which can be combined to cover all dimensions from 1-4" to 1". They are made of high grade tool steel, hardened, and ground to very close limits. The tops or measuring surfaces are ground on a radius according to the size of the hole in which they are to be used.

The many uses this set can be put to make it very handy and useful in the shop where a complete set of plug gauges is not kept on hand. The gauges are packed in a neat wooden case and a plate in the cover gives the different ranges obtainable with different combinations of gauges.

Packed one set in a box.

## Rolling Mill Caliper Gauge No. 674



Tongue Graduated on one side to 32nds of an inch.

**Price, \$9.00**

This rolling mill caliper gauge is made of tool steel, drop-forged. The jaw and slide are made in one piece so that the tool is especially strong to withstand the severe strains of use on a heavy class of work as in measuring sheet iron and steel in Rolling Mills. The jaws are hardened.

This gauge is equally as useful in stock and storerooms but is designed especially to withstand the more severe requirements of heavy work.

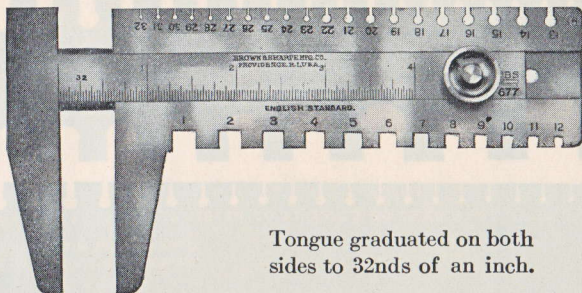
This tool is 5 13-16" long and 17-32" thick. The jaws are 2 1-8" deep and can be drawn apart to measure 4". The slide can be securely clamped in position by the **Clamp Nut**.

Packed one in a box.



## Caliper and Wire Gauge No. 677

### ENGLISH OR BIRMINGHAM STANDARD



Tongue graduated on both sides to 32nds of an inch.

**Price, \$13.50**

This tool is found especially useful in the stock and store room for selecting iron, steel and sheet stock and for gauging wire.

It is made of steel, 5 3-4" long and 3-16" thick. The jaws are hardened and 2" deep, and can be drawn apart to measure 4". The slide can be clamped in position by the **clamp nut**.

The gauge numbers are of the English or Birmingham Standard and run from 1 to 32.

## Caliper Gauge No. 680

### U. S. STANDARD

#### For Sheet and Plate Iron and Steel

**Price, \$13.50**

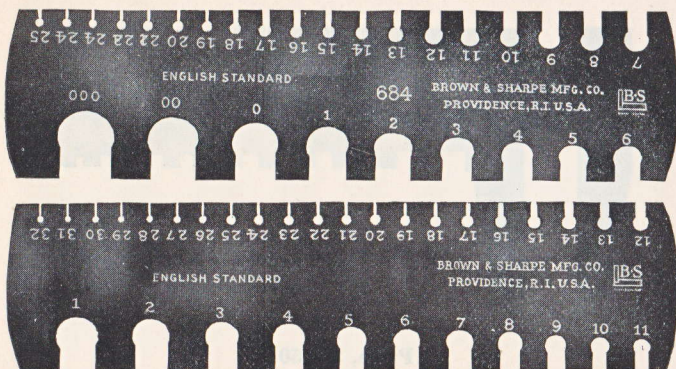
Tongue graduated on both sides to 32nds of an inch.

This tool is similar in design to gauge No. 677, but has the U. S. Standard gauge numbers which run from 1 to 32.

Each of the above packed one in a box.

## Rolling Mill Gauge No. 684

### ENGLISH OR BIRMINGHAM STANDARD



Numbers 000 to 25

Price, \$4.00

Numbers 1 to 32

Price, 4.75

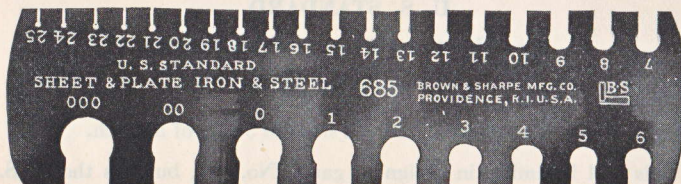
These gauges are made of steel, hardened and tempered. They are about 3-16" thick and well adapted to the rough usage they are likely to receive in rolling mills or in other places where many measurements are to be taken quickly.

## Rolling Mill Gauge No. 685

### U. S. STANDARD

Adopted by Congress, March 3, 1893

For Sheet and Plate Iron and Steel



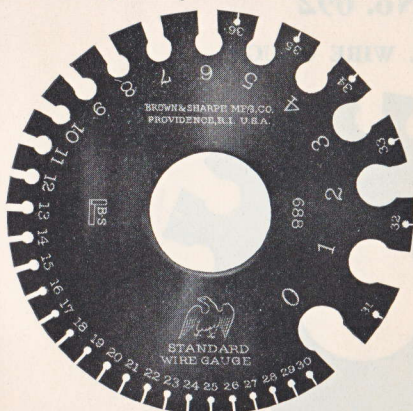
Numbers 000 to 25

Price, \$4.00

Each of the above packed six in a box.

## American Standard Wire Gauges No. 688

Adopted by the Brass Manufacturers, January, 1858



This gauge is particularly useful to electricians and others who desire a standard gauge for measuring non-ferrous metals, both sheet and wire.

It is made in two sizes, the large size having numbers from 0 to 36 and the small size from 5 to 36. Decimal Equivalents are stamped on the reverse side.

### Prices

Nos. 0 to 36, \$3.00

Nos. 5 to 36, 2.50

For table of the Different Standards of Wire Gauges, see page 174

## English Standard Wire Gauges No. 690

Same as Stubs Iron Wire or Birmingham Gauge

The Stubs Iron Wire Gauge is the one commonly known as the English Standard or Birmingham Gauge (and designates the Stubs Soft Wire Sizes).

Decimal equivalents are stamped on reverse side.

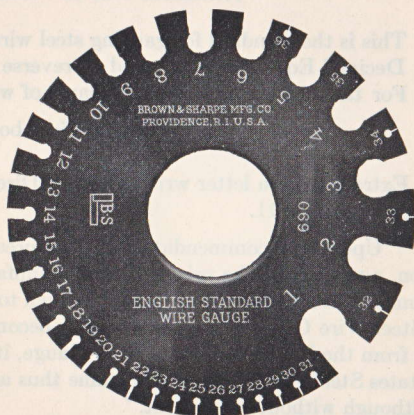
### Prices

Nos. 1 to 36, \$3.00

Nos. 6 to 36, 2.50

For table of different Standards of Wire Gauges, see page 174.

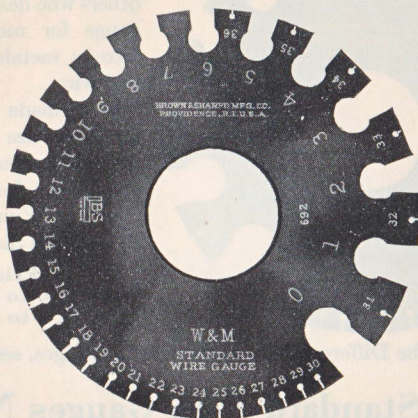
Each of the above packed as follows: Small size twelve, and large size six in a box.





# Washburn & Moen Standard Wire Gauge No. 692

## \*STEEL WIRE GAUGE



Numbers 0 to 36    Price, \$3.00

This is the standard for gauging steel wire and drill rod.

Decimal Equivalents stamped on reverse side.

For table of the different standards of wire gauges, see page 174.

Packed six in a box.

Extract from a letter written by the Director, U.S. Bureau of Standards, July 7, 1911.

\*"Upon the recommendation of the Bureau of Standards at Washington, a number of the principal wire manufacturers and important consumers have agreed that it would be well to designate this gauge as the 'Steel Wire Gauge'; in cases where it becomes necessary to distinguish it from the British Standard Wire Gauge, it may be called the 'United States Steel Wire Gauge'. The name thus adopted has official sanction, although without legal effect."

## U. S. Standard Gauge No. 694

Adopted by Congress, March 3, 1893

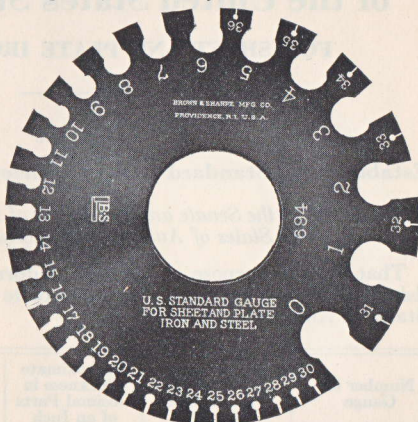
Numbers 0 to 36

Price, \$3.00

This is the legalized gauge for determining duties and taxes levied by the U. S. and is the recognized commercial standard for all un-coated sheet and plate iron and steel. It is a weight gauge having been based on weights in ounces per square foot.

Decimal Equivalents stamped on reverse side.

For table of the different standards of wire gauges, see page 174.



## Steel Music Wire Gauge No. 696

AMERICAN S. & W. CO.'S STANDARD

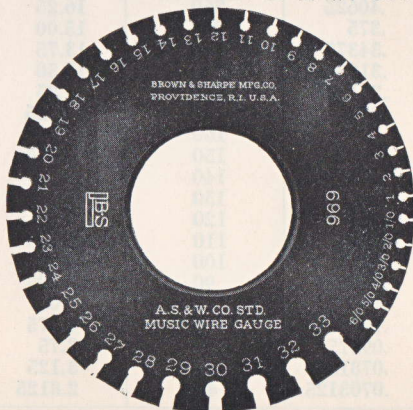
Numbers 000000 to 33

Price, \$3.00

Decimal Equivalents stamped on reverse side.

This gauge carries all sizes for measuring and checking steel music wire.

For table of different standards of wire gauges, see page 174.



Each of the above packed six in a box.

# Sizes of Numbers of the United States Standard Gauge

## FOR SHEET AND PLATE IRON AND STEEL

### An Act

#### Establishing a Standard Gauge for Sheet and Plate Iron and Steel

*Be it enacted by the Senate and the House of Representatives of the United States of America in Congress assembled:*

That for the purpose of securing uniformity the following is established as the only gauge for sheet and plate iron and steel in the United States of America, namely:

Number of Gauge	Approximate Thickness in Fractions of an Inch	Approximate Thickness in Decimal Parts of an Inch	Weight per Square Foot in Ounces Avoirdupois	Weight per Square Foot in Pounds Avoirdupois
0000000	1-2	.5	320	20.00
000000	15-32	.46875	300	18.75
00000	7-16	.4375	280	17.50
0000	13-32	.40625	260	16.25
000	3-8	.375	240	15.00
00	11-32	.34375	220	13.75
0	5-16	.3125	200	12.50
1	9-32	.28125	180	11.25
2	17-64	.265625	170	10.625
3	1-4	.25	160	10.00
4	15-64	.234375	150	9.375
5	7-32	.21875	140	8.75
6	13-64	.203125	130	8.125
7	3-16	.1875	120	7.5
8	11-64	.171875	110	6.875
9	5-32	.15625	100	6.25
10	9-64	.140625	90	5.625
11	1-8	.125	80	5.00
12	7-64	.109375	70	4.375
13	3-32	.09375	60	3.75
14	5-64	.078125	50	3.125
15	9-128	.0703125	45	2.8125

*List continued on next page.*



# Sizes of Numbers of the United States Standard Gauge

FOR SHEET AND PLATE IRON AND STEEL

(Continued)

Number of Gauge	Approximate Thickness in Fractions of an Inch	Approximate Thickness in Decimal Parts of an Inch	Weight per Square Foot in Ounces Avoirdupois	Weight per Square Foot in Pounds Avoirdupois
16	1-16	.0625	40	2.5
17	9-160	.05625	36	2.25
18	1-20	.05	32	2.
19	7-160	.04375	28	1.75
20	3-80	.0375	24	1.50
21	11-320	.034375	22	1.375
22	1-32	.03125	20	1.25
23	9-320	.028125	18	1.125
24	1-40	.025	16	1.
25	7-320	.021875	14	.875
26	3-160	.01875	12	.75
27	11-640	.0171875	11	.6875
28	1-64	.015625	10	.625
29	9-640	.0140625	9	.5625
30	1-80	.0125	8	.5
31	7-640	.0109375	7	.4375
32	13-1280	.01015625	6 1-2	.40625
33	3-320	.009375	6	.375
34	11-1280	.00859375	5 1-2	.34375
35	5-640	.0078125	5	.3125
36	9-1280	.00703125	4 1-2	.28125
37	17-2560	.006640625	4 1-4	.265625
38	1-160	.00625	4	.25

And on and after July 1, 1893, the same and no other shall be used in determining duties and taxes levied by the United States of America on sheet and plate iron and steel. But this act shall not be construed to increase duties upon any articles which may be imported.

Sec. 3. That in the practical use and application of the standard gauge hereby established a variation of two and one-half per cent either way may be allowed.

Approved March 3, 1893.

# Different Standards for Wire Gauges

## In use in the United States

### Dimensions of Sizes in Decimal Parts of an Inch

Number of Wire Gauge	American or Brown & Sharpe	Birmingham, or Stubs' Iron Wire	Washburn & Moen, or Steel Wire Gauge	American S. & W. Co.'s Music Wire	Imperial Wire	Stubs' Steel Wire	U. S. Standard Gauge for Sheet & Plate Iron & Steel	Number of Wire Gauge
00000000	....	..	..	..	....	..	....	00000000
0000000	....	..	.4900	..	....	..	....	0000000
000000	....	..	.4615	.004	.464	..	.46875	000000
00000	....	..	.4305	.005	.432	..	.4375	00000
0000	.460	.454	.3938	.006	.400	..	.40625	0000
000	.40964	.425	.3625	.007	.372	..	.375	000
00	.3648	.380	.3310	.008	.348	..	.34375	00
0	.32486	.340	.3065	.009	.324	..	.3125	0
1	.2893	.300	.2830	.010	.300	.227	.28125	1
2	.25763	.284	.2625	.011	.276	.219	.265625	2
3	.22942	.259	.2437	.012	.252	.212	.250	3
4	.20431	.238	.2253	.013	.232	.207	.234375	4
5	.18194	.220	.2070	.014	.212	.204	.21875	5
6	.16202	.203	.1920	.016	.192	.201	.203125	6
7	.14428	.180	.1770	.018	.176	.199	.1875	7
8	.12849	.165	.1620	.020	.160	.197	.171875	8
9	.11443	.148	.1483	.022	.144	.194	.15625	9
10	.10189	.134	.1350	.024	.128	.191	.140625	10
11	.090742	.120	.1205	.026	.116	.188	.125	11
12	.080808	.109	.1055	.029	.104	.185	.109375	12
13	.071961	.095	.0915	.031	.092	.182	.09375	13
14	.064084	.083	.0800	.033	.080	.180	.078125	14
15	.057068	.072	.0720	.035	.072	.178	.0703125	15
16	.05082	.065	.0625	.037	.064	.175	.0625	16
17	.045257	.058	.0540	.039	.056	.172	.05625	17
18	.040303	.049	.0475	.041	.048	.168	.050	18
19	.03589	.042	.0410	.043	.040	.164	.04375	19
20	.031961	.035	.0348	.045	.036	.161	.0375	20
21	.028462	.032	.0317	.047	.032	.157	.034375	21
22	.025347	.028	.0286	.049	.028	.155	.03125	22
23	.022571	.025	.0258	.051	.024	.153	.028125	23
24	.0201	.022	.0230	.055	.022	.151	.025	24
25	.0179	.020	.0204	.059	.020	.148	.021875	25
26	.01594	.018	.0181	.063	.018	.146	.01875	26
27	.014195	.016	.0173	.067	.0164	.143	.0171875	27
28	.012641	.014	.0162	.071	.0149	.139	.015625	28
29	.011257	.013	.0150	.075	.0136	.134	.0140625	29
30	.010025	.012	.0140	.080	.0124	.127	.0125	30
31	.008928	.010	.0132	.085	.0116	.120	.0109375	31
32	.00795	.009	.0128	.090	.0108	.115	.01015625	32
33	.00708	.008	.0118	.095	.0100	.112	.009375	33
34	.006304	.007	.0104	..	.0092	.110	.00859375	34
35	.005614	.005	.0095	..	.0084	.108	.0078125	35
36	.005	.004	.0090	..	.0076	.106	.00703125	36
37	.004453	..	.0085	..	.0068	.103	.006640625	37
38	.003965	..	.0080	..	.0060	.101	.00625	38
39	.003531	..	.0075	..	.0052	.099	....	39
40	.003144	..	.0070	..	.0048	.097	....	40

# Table of Decimal Equivalents

## Stubs' Steel Wire Gauge

Letter	Size of Letter in Decimals	No. of Wire Gauge	Size of Number in Decimals	No. of Wire Gauge	Size of Number in Decimals	No. of Wire Gauge	Size of Number in Decimals
Z	.413	1	.227	28	.139	55	.050
Y	.404	2	.219	29	.134	56	.045
X	.397	3	.212	30	.127	57	.042
W	.386	4	.207	31	.120	58	.041
V	.377	5	.204	32	.115	59	.040
U	.368	6	.201	33	.112	60	.039
T	.358	7	.199	34	.110	61	.038
S	.348	8	.197	35	.108	62	.037
R	.339	9	.194	36	.106	63	.036
Q	.332	10	.191	37	.103	64	.035
P	.323	11	.188	38	.101	65	.033
O	.316	12	.185	39	.099	66	.032
N	.302	13	.182	40	.097	67	.031
M	.295	14	.180	41	.095	68	.030
L	.290	15	.178	42	.092	69	.029
K	.281	16	.175	43	.088	70	.027
J	.277	17	.172	44	.085	71	.026
I	.272	18	.168	45	.081	72	.024
H	.266	19	.164	46	.079	73	.023
G	.261	20	.161	47	.077	74	.022
F	.257	21	.157	48	.075	75	.020
E	.250	22	.155	49	.072	76	.018
D	.246	23	.153	50	.069	77	.016
C	.242	24	.151	51	.066	78	.015
B	.238	25	.148	52	.063	79	.014
A	.234	26	.146	53	.058	80	.013
..	...	27	.143	54	.055	..	...

## Stubs' Gauges

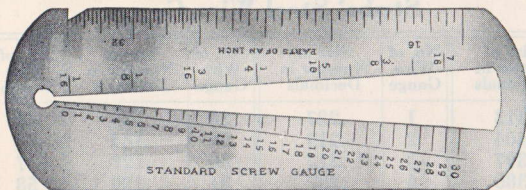
In using the gauges known as Stubs' Gauges, there should be constantly borne in mind the difference between the Stubs' Iron Wire Gauge and the Stubs' Steel Wire Gauge.

The Stubs' Iron Wire Gauge is the one commonly known as the English Standard Wire, or Birmingham Gauge, and designates the Stubs' soft wire sizes.

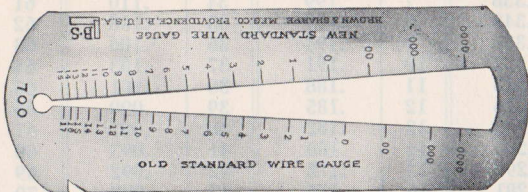
The Stubs' Steel Wire Gauge is the one that is used in measuring drawn steel wire or drill rods of Stubs' make and is also used by many makers of American drill rods.



## Pocket Screw and Wire Gauge No. 700



Front Side



Back Side

**Price, \$3.00**

This gauge is graduated on the front and back and is designed for the measurement of wire as well as of machine and wood screws. The screw or wire to be measured is passed into the angular opening until it touches on both sides; the division at the point of contact indicates the number of the gauge of the wire or screw.

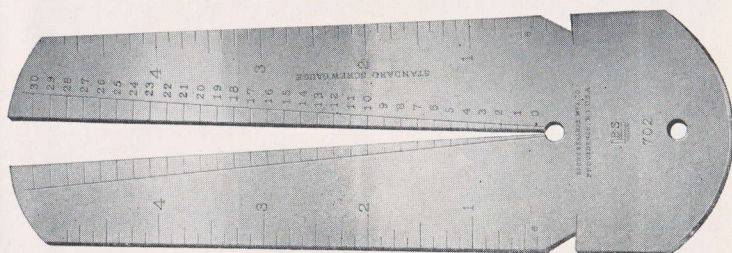
The front side is graduated for all sizes of American Standard Screws from 0 to 30, or to measure diameters of wire or screws from 1-16" to 7-16". One outside edge of the front side is also graduated in 32nds and 16ths of an inch. The back side of the gauge is graduated to measure the old or English wire gauge, from 17 to 0000, or to measure the new or American wire gauge from 15 to 0000.

The gauge can also be used to show the size of the A. S. M. E. Standard Screws. Although there is a slight difference in the size for the same gauge numbers, it is not enough to affect the reading of the gauge. For a comparison of these sizes see the following page.

**Packed six in a box.**

# Large Screw and Wire Gauge No. 702

Price, \$5.50



This gauge is graduated on both sides of the slot to show all sizes of the American Standard screw gauge from 0 to 30 and is designed for the measurement of wire as well as of machine and wood screws.

This gauge can also be used to show the size of A. S. M. E. Standard screws. Although there is a slight difference in size for the same gauge number it is not enough to affect the reading of the gauge. For a comparison of these sizes see page 177.

A screw or wire is measured by passing it into the angular opening till it touches on both sides; the division at the point of contact indicates the number of the gauge stamped on the side of the slot.

The front of the gauge is also graduated on both edges to 8ths of an inch. An angle cut in the side allows the head of the screw to be placed against a positive stop when measuring the length.

The back of the gauge is graduated as the old or English wire gauge from 17 to 0000 on the right, and to 32nds of an inch on the left of the slot. The outer left-hand edge is graduated to 32nds of an inch.

Packed six in a box.





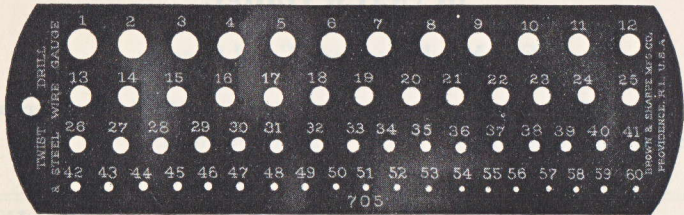
# Table of Decimal Equivalents of Screw Gauge

## For Machine and Wood Screws

The difference between consecutive sizes is .01316" for American Screw Co. Standard; .013" for A. S. M. E. Standard.

No. of Screw Gauge	Size of Number in Decimals		No. of Screw Gauge	Size of Number in Decimals		No. of Screw Gauge	Size of No. in Decimals
	American Screw Co. Standard	A. S. M. E. Basic and Maximum Outside Diameter		American Screw Co. Standard	A. S. M. E. Basic and Maximum Outside Diameter		American Screw Co. Standard
000	.03152	...	16	.26840	.268	34	.50528
00	.04468	...	17	.28156	...	35	.51844
0	.05784	.060	18	.29472	.294	36	.53160
1	.07100	.073	19	.30788	...	37	.54476
2	.08416	.086	20	.32104	.320	38	.55792
3	.09732	.099	21	.33420	...	39	.57108
4	.11048	.112	22	.34736	.346	40	.58424
5	.12364	.125	23	.36052	...	41	.59740
6	.13680	.138	24	.37368	.372	42	.61056
7	.14996	.151	25	.38684	...	43	.62372
8	.16312	.164	26	.40000	.398	44	.63688
9	.17628	.177	27	.41316	...	45	.65004
10	.18944	.190	28	.42632	.424	46	.66320
11	.20260	...	29	.43948	...	47	.67636
12	.21576	.216	30	.45264	.450	48	.68952
13	.22892	...	31	.46580	...	49	.70268
14	.24208	.242	32	.47896	...	50	.71584
15	.25524	...	33	.49212	...	..	.....

# Twist Drill and Steel Wire Gauge No. 705



Nos. 1 to 60. Price, \$2.00



Nos. 61 to 80. Price, \$2.40

For use in determining the correct size of Twist Drills and Steel Drill Rods. Great care is taken to insure the accuracy of the gauge numbers. All sizes are carefully tested after hardening.

The larger Gauge is about 1-16" thick, 1 5-8" wide, 5 1-4" long and contains gauge numbers from 1 to 60, inclusive, with decimal equivalents of the various sizes stamped on reverse side. The smaller Gauge is about 1-16" thick, 3-4" wide, 2" long and contains gauge numbers from 61 to 80, inclusive. These Gauges are usually sent out finished black, but will be sent polished, if desired, at the same price.

For table of Decimal Equivalents of the Numbers of Twist Drill and Steel Wire Gauge, see next page.

Each of the above packed six in a box.

# Decimal Equivalents

of the

## Numbers of Twist Drill and Steel Wire Gauge

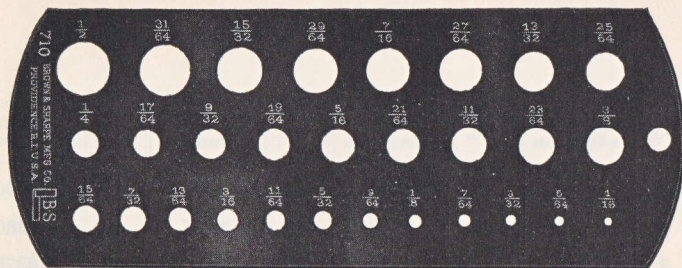
No.	Size of No. in Decimals	No.	Size of No. in Decimals	No.	Size of No. in Decimals	No.	Size of No. in Decimals
1	.2280	21	.1590	41	.0960	61	.0390
2	.2210	22	.1570	42	.0935	62	.0380
3	.2130	23	.1540	43	.0890	63	.0370
4	.2090	24	.1520	44	.0860	64	.0360
5	.2055	25	.1495	45	.0820	65	.0350
6	.2040	26	.1470	46	.0810	66	.0330
7	.2010	27	.1440	47	.0785	67	.0320
8	.1990	28	.1405	48	.0760	68	.0310
9	.1960	29	.1360	49	.0730	69	.02925
10	.1935	30	.1285	50	.0700	70	.0280
11	.1910	31	.1200	51	.0670	71	.0260
12	.1890	32	.1160	52	.0635	72	.0250
13	.1850	33	.1130	53	.0595	73	.0240
14	.1820	34	.1110	54	.0550	74	.0225
15	.1800	35	.1100	55	.0520	75	.0210
16	.1770	36	.1065	56	.0465	76	.0200
17	.1730	37	.1040	57	.0430	77	.0180
18	.1695	38	.1015	58	.0420	78	.0160
19	.1660	39	.0995	59	.0410	79	.0145
20	.1610	40	.0980	60	.0400	80	.0135



# Jobbers' Drill Gauge No. 710

For Gauging Twist Drills

Tempered



Price, \$2.75

The sizes are carefully tested for accuracy after tempering.

This gauge is usually sent out finished black, but will be sent polished, if desired, at the same price.

Table of Equivalents of Sizes in Decimal Parts of an Inch.

Size, Inches	Decimal	Size, Inches	Decimal
1-16	.0625	19-64	.29687
5-64	.07812	5-16	.3125
3-32	.09375	21-64	.32812
7-64	.10937	11-32	.34375
1-8	.125	23-64	.35937
9-64	.14062	3-8	.375
5-32	.15625	25-64	.39062
11-64	.17187	13-32	.40625
3-16	.1875	27-64	.42187
13-64	.20312	7-16	.4375
7-32	.21875	29-64	.45312
15-64	.23437	15-32	.46875
1-4	.25	31-64	.48437
17-64	.26562	1-2	.50
9-32	.28125	...	.....

Packed six in a box.

## Sizes of Tap Drills for U. S. Standard Threads

By the formulas given below, the results, strictly speaking, are the diameters of the bottoms of the threads. The tap drill is, in common practice, one or two numbers larger, for the smaller, or numbered sizes, and about .005" larger for the larger sizes. The amount allowed for clearance varies in different shops and on different classes of work.

Bottom of Thread Diameter for U. S. Standard Thread =  

$$\text{outside diameter of Screw} - \frac{1.299}{\text{Threads per inch}}$$

Bottom of Thread Diameter for 3-4" Screw, U. S. Standard Thread,  
 10 threads to the inch =  $.750 - \frac{1.299}{10} = .750 - .1299 = .6201$ .

Diameter of Screw, Inches	Threads per Inch	Diameter at Bottom of Thread, Inches	Diameter of Screw, Inches	Threads per Inch	Diameter at Bottom of Thread, Inches
1-4	20	.185	2	4 1-2	1.712
5-16	18	.240	2 1-4	4 1-2	1.962
3-8	16	.294	2 1-2	4	2.176
7-16	14	.344	2 3-4	4	2.426
1-2	13	.400	3	3 1-2	2.629
9-16	12	.454	3 1-4	3 1-2	2.879
5-8	11	.507	3 1-2	3 3-4	3.100
3-4	10	.620	3 3-4	3	3.317
7-8	9	.731	4	3	3.567
1	8	.837	4 1-4	2 7-8	3.798
1 1-8	7	.940	4 1-2	2 3-4	4.028
1 1-4	7	1.065	4 3-4	2 5-8	4.256
1 3-8	6	1.160	5	2 1-2	4.480
1 1-2	6	1.284	5 1-4	2 1-2	4.730
1 5-8	5 1-2	1.389	5 1-2	2 3-8	4.953
1 3-4	5	1.491	5 3-4	2 3-8	5.203
1 7-8	5	1.616	6	2 1-4	5.423

## Sizes of Tap Drills for V Threads

Bottom of Thread Diameter for V Thread = outside diameter of  

$$\text{Screw} - \frac{1.732}{\text{Threads per inch}}$$

Bottom of Thread Diameter for 3-4" V Thread, 10 threads per inch =  

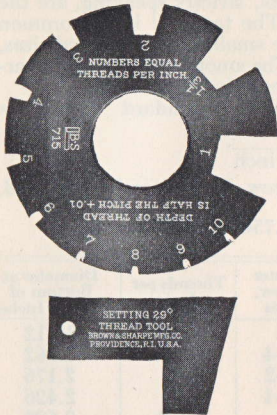
$$.750 - \frac{1.732}{10} = .750 - .1732 = .5768, \text{ diameter at bottom of thread.}$$

The Tap Drill should be from .010 larger than above figures on small sizes to .030 larger on large sizes.

## 29° Screw Thread Gauge No. 715

Acme Standard

Price, \$3.30



This gauge furnishes a correct standard to which thread tools can be ground to cut threads of a uniform angle to take the place of square threads and to standardize the threads of various angles and depths now in use. The Acme thread has the same depth as the square thread, but is stronger.

The sides are at an inclination of  $14\frac{1}{2}^\circ$ , or  $29^\circ$  included angle, which angle is the same as is now generally adopted in cutting worms.

A tool setting gauge is furnished and included in the price of each gauge.

Packed six in a box.

## Improved 29° Screw Thread Tool Gauge No. 716

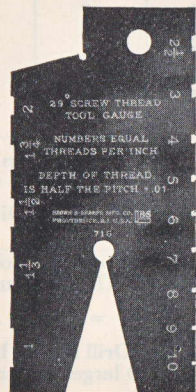
Acme Standard

Price, \$3.00

This gauge furnishes a correct standard to which thread tools can be ground for cutting threads of a uniform angle to take the place of square threads.

The Acme thread has the same depth as the square thread, but as the sides are at an inclination of  $14\frac{1}{2}^\circ$  ( $29^\circ$  included angle) this form of thread is stronger.

Packed twelve in a box.





## 29° Screw Thread

### ACME STANDARD

The various parts of the 29° Screw Thread, Acme Standard, are obtained as follows:

Width of Point of Tool for Screw or Tap Thread =

$$\frac{.3707}{\text{Threads per inch}} - .0052$$

Width of Screw or Nut Thread =  $\frac{.3707}{\text{Threads per inch}}$

Diameter of Tap = Diameter of Screw + .020

Diameter of Tap or Screw at Root =

$$\text{Diameter of Screw} - \left( \frac{1}{\text{Threads per inch}} + .020 \right)$$

$$\text{Depth of Thread} = \frac{1}{2 \times \text{Threads per inch}} + .010$$

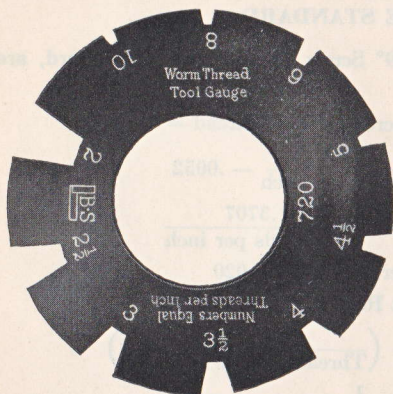
### Table of Thread Parts

Threads per Inch	Depth of Thread, Inches	Thickness at Top of Thread, Inches	Width Space at Bottom of Thread, Inches	Space at Top of Thread, Inches	Thickness at Root of Thread Inches
1	.5100	.3707	.3655	.6293	.6345
1 1-3	.3850	.2780	.2728	.4720	.4772
2	.2600	.1853	.1801	.3147	.3199
3	.1767	.1235	.1183	.2098	.2150
4	.1350	.0927	.0875	.1573	.1625
5	.1100	.0741	.0689	.1259	.1311
6	.0933	.0618	.0566	.1049	.1101
7	.0814	.0529	.0478	.0899	.0951
8	.0725	.0463	.0411	.0787	.0839
9	.0655	.0413	.0361	.0699	.0751
10	.0600	.0371	.0319	.0629	.0681

## Worm Thread Tool Gauge No. 720

Price, \$3.00

Price, with Tool Setting Gauge, \$3.30



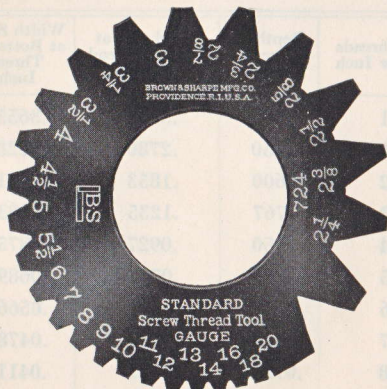
Furnishes the correct form for tools used in turning the threads of worms when the worm wheels are cut with involute cutters. The figures on the gauge correspond to the number of threads per inch of the worm.

## U. S. Standard Screw Thread Tool Gauge No. 724

Price, \$3.00

This gauge is used as a standard for grinding tools to cut threads according to the United States Standards.

The angles are 60°, and the flat surfaces at top and bottom of threads are equal to one-eighth of the pitch.



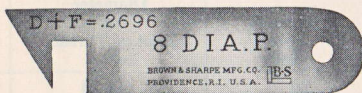
Each of the above packed six in a box.

# U. S. Standard Screw Threads

Diameter of Screw at Top of Thread, Inches	Threads per Inch	Diameter at Root of Thread, Inches	Width of Flat, Top and Bottom, Inches
1-4	20	.1850	.0063
5-16	18	.2403	.0069
3-8	16	.2936	.0078
7-16	14	.3447	.0089
1-2	13	.4001	.0096
9-16	12	.4542	.0104
5-8	11	.5069	.0114
3-4	10	.6201	.0125
7-8	9	.7307	.0139
1	8	.8376	.0156
1 1-8	7	.9394	.0179
1 1-4	7	1.0644	.0179
1 3-8	6	1.1585	.0208
1 1-2	6	1.2835	.0208
1 5-8	5 1-2	1.3888	.0227
1 3-4	5	1.4902	.0250
1 7-8	5	1.6152	.0250
2	4 1-2	1.7113	.0278
2 1-4	4 1-2	1.9613	.0278
2 1-2	4	2.1752	.0313
2 3-4	4	2.4252	.0313
3	3 1-2	2.6288	.0357
3 1-4	3 1-2	2.8788	.0357
3 1-2	3 1-4	3.1003	.0385
3 3-4	3	3.3170	.0417
4	3	3.5670	.0417
4 1-4	2 7-8	3.7982	.0435
4 1-2	2 3-4	4.0276	.0455
4 3-4	2 5-8	4.2551	.0476
5	2 1-2	4.4804	.0500
5 1-4	2 1-2	4.7304	.0500
5 1-2	2 3-8	4.9530	.0526
5 3-4	2 3-8	5.2030	.0526
6	2 1-4	5.4226	.0556



## Depth of Gear Tooth Gauges No. 725



Regular pitches from 3 to 48, inclusive

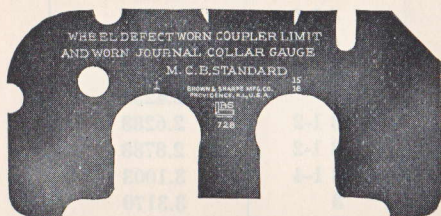
Price, 75 Cents Each

Other sizes made to order — Prices on application

Depth of Gear Tooth Gauges for all regular pitches, from 3 to 48 pitch, inclusive, are carried in stock. One gauge answers for each pitch and indicates the extreme depth gear tooth is to be cut.

Packed one in a package.

## Wheel Defect, Worn Coupler Limit and Worn Journal Collar Gauge No. 728



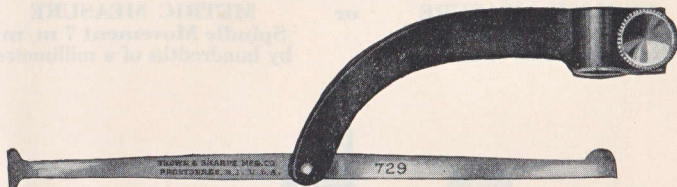
Price, \$3.00

Designed for ascertaining the extent of defects and wear in car wheels, journal collars and couplers, according to the standard adopted by the Master Car Builders' Association.

It is shown about half size and is made of first quality tool steel, hardened. The measuring surfaces are accurately ground and finished to size.

Packed six in a box.

## Dial Test Indicator Attachment No. 729



**Price, \$1.75**

This attachment greatly increases the usefulness of the Dial Test Indicator by adapting it for testing internal and other surfaces that cannot be reached conveniently with the straight spindle of the dial indicator.

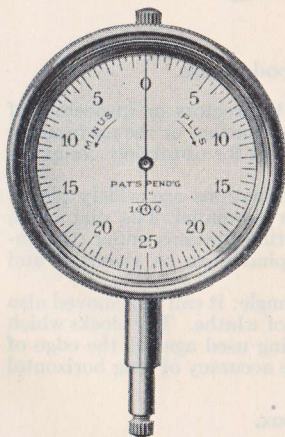
The attachment is easily and quickly attached and firmly held by a knurled clamp screw.

## Dial Gauges

**For Dial Test Indicators**

**ENGLISH MEASURE OR METRIC MEASURE**

**Price, \$12.50**



Dial gauges can be attached to any of our indicators or used on special attachments for testing purposes on machine work or for bench work.

The Dial reads plus and minus either side of zero and the graduations are of such a size that fractions of a thousandth of an inch or of a hundredth of a millimetre can be easily estimated.

**English Measure.** Dial graduated in thousandths of an inch, is 1 3/4" in diameter and has a 3-10" spindle movement.

**Metric Measure.** Dial graduated in hundredths of a millimetre, is 1 3/4" wide and has a 7 m/m spindle movement.

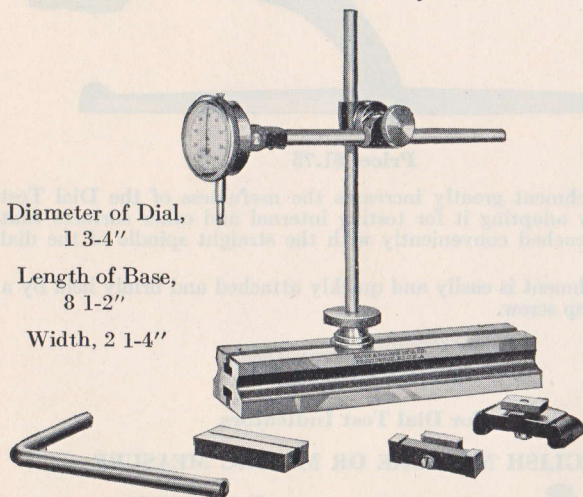
Each of the above packed one in a box.

## Dial Test Indicator No. 730

**ENGLISH MEASURE**  
**Spindle Movement 3-10"**  
 by thousandths of an inch

or

**METRIC MEASURE**  
**Spindle Movement 7 m/m**  
 by hundredths of a millimetre



Diameter of Dial,  
 1 3-4"

Length of Base,  
 8 1-2"

Width, 2 1-4"

**Price, \$30.00**

Price includes finished wooden case.

This Indicator is especially serviceable to erectors or inspectors of machines, for determining the inaccuracy in a surface or the movements of a spindle or arbor, etc.; also to tool makers for obtaining comparative measurements on very close work.

The pointer is very sensitive and the graduations are widely placed so that half or quarter thousandths can be estimated. The dial has a white enamelface and may be turned to bring the zero under the index pointer. The points of the indicator spindle can be removed and different lengths and forms of points used.

The horizontal arm is adjustable to any angle; it can be removed also and used independently as in the tool post of a lathe. The blocks which fit into the T slot in the base permit its being used against the edge of a surface plate or T slot, for checking the accuracy of long horizontal surfaces.

Packed one in a box.



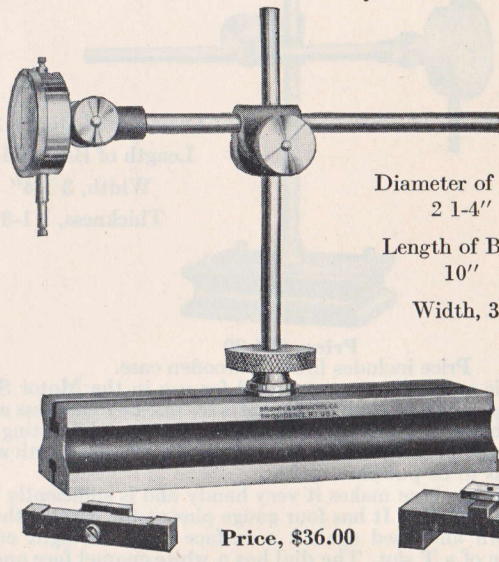
# Dial Test Indicator No. 732

## Heavy Base

**ENGLISH MEASURE**  
Spindle Movement 1-2"  
by thousandths of an inch

or

**METRIC MEASURE**  
Spindle Movement 13 m/m  
by hundredths of a millimetre



Diameter of Dial,  
2 1/4"

Length of Base,  
10"

Width, 3"

**Price, \$36.00**

Price includes finished wooden case.

This indicator is especially serviceable to erectors or inspectors of machines where an Indicator with extra heavy base is required.

The pointer is very sensitive and the graduations are widely spaced so that half or quarter thousandths can be estimated. The dial has a white enamel face and may be turned to bring the zero under the index pointer. The points of the indicator spindle can be removed and different lengths and forms of points used. The 1-2" spindle movement of the dial of this indicator allows it to be used for many purposes where a dial with shorter spindle movement is not as convenient.

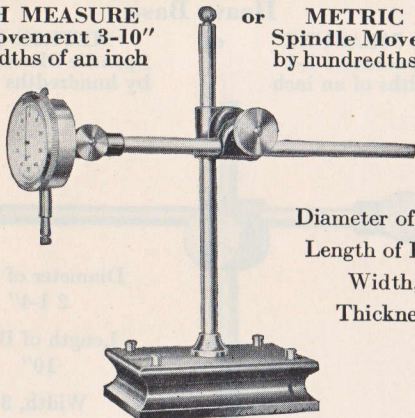
The horizontal arm is adjustable to any angle; it can be removed also and used independently. The blocks which fit into the T slot in the base permit its being used against the edge of a surface plate or T slot, for checking the accuracy of long horizontal surfaces.

Packed one in a box.

## Dial Test Indicator No. 733

**ENGLISH MEASURE**  
Spindle Movement 3-10"  
by thousandths of an inch

or **METRIC MEASURE**  
Spindle Movement 7 m/m  
by hundredths of a millimetre



Diameter of Dial, 1 3-4"

Length of Base, 4 1-4"

Width, 3 1-4"

Thickness, 1 1-8"

**Price, \$24.00**

Price includes finished wooden case.

This gauge is especially recommended for use in the Motor Service Shop for testing camshafts and crankshafts for out-of-roundness and for setting crankshafts in grinding machines and accurately setting a fly-wheel in the lathe preparatory to turning off the old gear teeth when a new gear ring is to be put on.

The design of the base makes it very handy and is sufficiently heavy to give it a firm support. It has four gauge pins at the corners that can be pushed down and used against a surface plate, straight edge or against the side of a T slot. The dial has a white enamel face and may be turned to bring the zero under the index pointer.

## Universal Attachment No. 734

**For Use on Dial Test Indicators Nos. 730, 732 and 733**

Designed for testing internal and other surfaces that cannot be reached conveniently with the regular straight spindle of the indicator.

It consists of a small steel cylinder that clamps over the end of the indicator spindle. Inside the cylinder a rod rests against the indicator point. This rod actuates the indicating point that extends at right angles to the regular indicator spindle and is so placed that it produces a direct thrust against the end of the spindle without friction on the side of the cylinder.



**Price, \$4.50**

Each of the above packed one in a box.

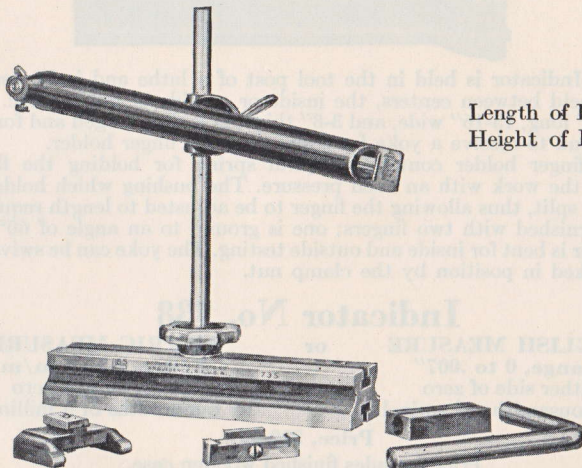
## Test Indicator No. 735

### ENGLISH MEASURE or

Range 1-100" either side of 0  
by thousandths of an inch

### METRIC MEASURE

Range 26-100 m/m either side of 0  
by fiftieths of a millimetre



Length of Base, 8"  
Height of Post, 9"

**Price, \$25.00**

Price includes finished wooden case.

The movement of the pointer on this Indicator is very sensitive and is magnified a number of times by the length of the index finger. Its movement is read upon the graduations, shown on the end of the body.

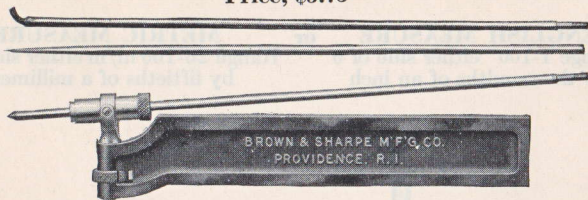
The indexing finger may be brought to zero by turning the knurled screw, no matter what position the arm is in.

Packed one in a box.



## Lathe Test Indicator No. 736

Price, \$3.75



This Indicator is held in the tool post of a lathe and is for testing pieces held between centers, the inside or outside of pulleys, etc. The bar is 6" long, 15-16" wide, and 3-8" thick. It is drop forged and formed at the end to receive a yoke for supporting the finger holder.

The finger holder contains a spiral spring for holding the finger against the work with an even pressure. The bushing which holds the finger is split, thus allowing the finger to be adjusted to length required. It is furnished with two fingers; one is ground to an angle of 60° and the other is bent for inside and outside testing. The yoke can be swiveled, and locked in position by the clamp nut.

## Indicator No. 738

**ENGLISH MEASURE**

or

**METRIC MEASURE**

Range, 0 to .007"

Range, 0 to 1 m/m

Either side of zero

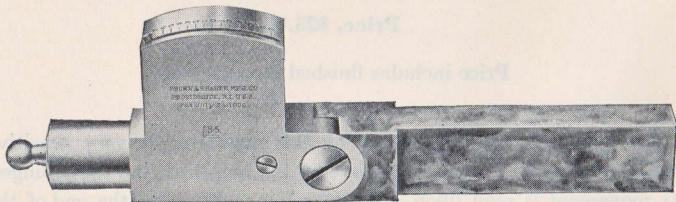
Either side of zero

by thousandths of an inch

by hundredths of a millimetre

Price, \$10.00

Price includes finished wooden case.



This Indicator is for centering work in a lathe, testing lathe centers, shafting, and work of a similar nature. The shank is made of hardened steel. It can be held in the tool post of a lathe and adjusted either upwards or downwards and readings obtained. The indicator point is of hardened steel, spherical in shape, allowing pressure to be brought upon it from any angle in taking readings.

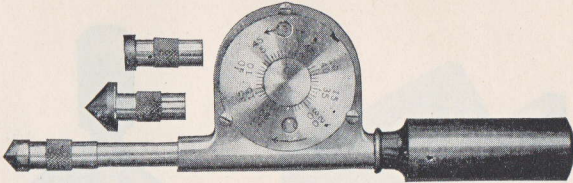
Each of the above packed one in a box.

## Speed Indicator No. 748

Price, \$6.75

Leather Case, \$1.50

Patented November 28, 1922



This Speed Indicator accurately determines the revolutions of shafting, etc., in either direction and measures both high and low speeds equally well. It has few parts, is simple in operation, and reliable.

The indicator registers up to 5,000 revolutions. Speeds faster than 5,000 R.P.M. can very readily be determined. All readings are taken from one side of the indicator and the two arrows on the face of the dial indicate the figures pertaining to the different directions of rotation, eliminating any confusion. It is merely necessary to place the point of the indicator on the spindle or shaft and watch the dial for a given time. The figures showing through the small round windows on the dial read every 5 revolutions. The inside dial reading every 100 revolutions is quickly returned to zero for repeated use by a knurled knob on the back of the indicator.

The fibre handle is conveniently shaped and is an insulation against electricity. All the working parts are enclosed in a heavily dull-nickelled case. Three points are furnished as shown. The steel point is for ordinary speeds and the rubber points are for high speeds.

This Speed Indicator is very neat, light, and convenient to handle, with no rough edges or projections to interfere with its use. Wherever the R.P.M. are to be determined or maintained, one of these indicators should be on hand.

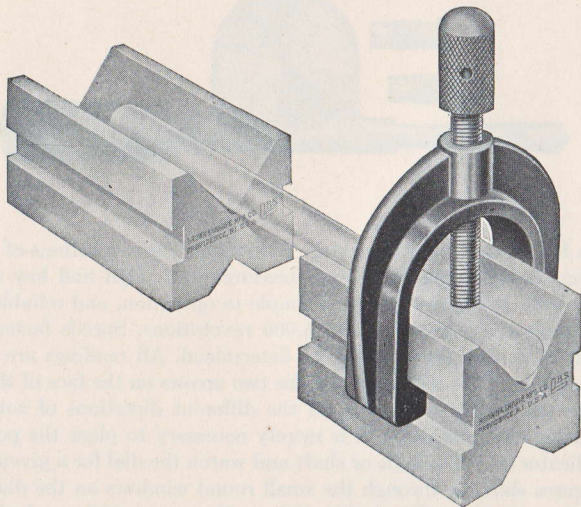
Packed one in a box.

## V Blocks and Clamp No. 749

Price, ~~\$1.50~~ \$1.85

Price Includes Two Blocks and One Clamp

Extra Clamps Price 60 cents each



For holding round work while drilling and for accurately laying out work in connection with a surface plate or knee.

The blocks are made of cast iron and intended for general machinists' use. They are carefully finished and the grooves are very accurate.

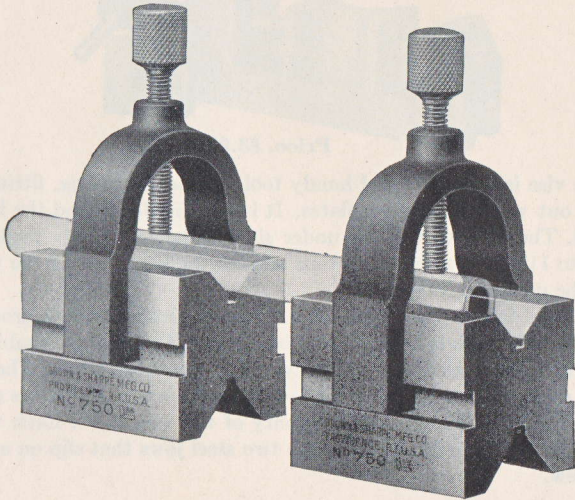
Each block is 2" long by 1 1-2" square and will take work up to 1 1-2" in diameter. The clamp is ribbed and very rugged and the screw has a knurled head with a hole in it to insert a rod for tightening the screw on the work. These blocks are not sold singly.

Packed two blocks and one clamp in a box.



## V Blocks and Clamps No. 750

Price per Pair, \$6.75



These blocks are designed to meet the demand for an accurate set of V Blocks. They are especially useful for accurately laying out work in connection with a surface plate, angle iron or knee. Round stock to be drilled, ground or milled can be clamped in the V's of these blocks and held fast.

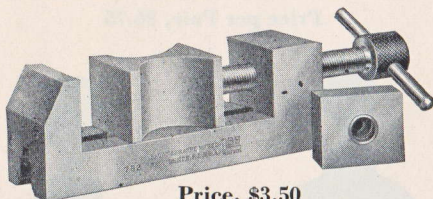
The blocks, which are made of tool steel and hardened, have the sides ground parallel and the V grooves carefully ground central and parallel to the bottom and sides. They are made and sold only in numbered pairs, so that the V grooves in blocks of the same numbers are always in alignment.

Each block is approximately 1 1-4" x 1 1-4" x 1 5-8" in size and will take work to 1" in diameter.

Not sold singly.

Packed one pair of blocks and two clamps in a box.

## Toolmakers' Vise No. 752



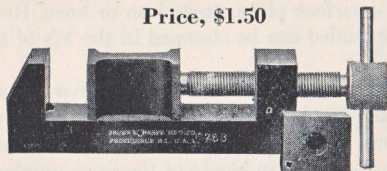
Price, \$3.50

This vise is a reliable and handy tool for use in drilling, fitting and laying out work on surface plates. It is case-hardened and the base is ground. The V groove in the under side of the base takes work from 9-32" to 11-16" diameter and thus adds to the handiness of the vise as it can be used as a V block.

The large jaw is provided with a tongue which slides in a groove in the base and which is held in place by a strap. This feature enables the vise to hold the work firmly and prevents the jaw from lifting. The strap can be removed and by using the jaw upside down, taper pieces can be held in the tool. The greatest capacity of the vise is 2". Each vise is furnished, as shown in the cut, with two steel jaws that slip on and off the screw.

## Toolmakers' Vise Clamp No. 753

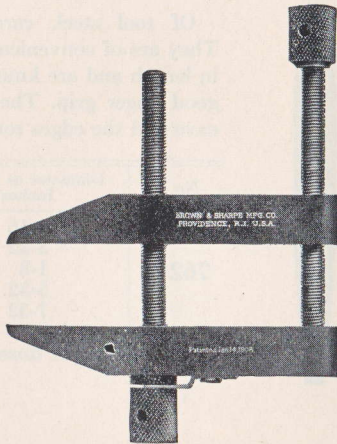
Price, \$1.50



This vise clamp is not provided with the V groove in the base or the tongue on the larger jaw and its corresponding slot. These vise clamps are generally used in pairs for holding work to be drilled, etc. The greatest capacity of this tool is 1  $\frac{3}{4}$ ".

Each of the above packed one in a box.

# Improved Toolmakers' Clamps No. 754



These Clamps are designed and proportioned throughout to insure the greatest strength and rigidity. The jaws are rounded on the ends to allow clamping under a shoulder or recess. The spring attachment holds the "loose" jaw tightly and prevents its dropping or sliding while opening or closing the clamp.

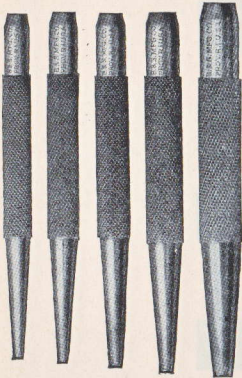
They are very convenient where a large number of pieces of the same size are to be clamped for drilling, as the spring attachment holds the jaws at the required distance for removing and inserting each piece.

No.	Opening of Jaws, Inches	Length of Jaws, Inches	Price, each
754	5-8	1 1-2	\$0.70
	1	2 1-8	.85
	1 1-2	2 3-4	1.00
	2	3 3-8	1.20
	2 1-2	4	1.30
	3 1-2	5	2.10

Packed one in a box.



Nail Sets No. 762



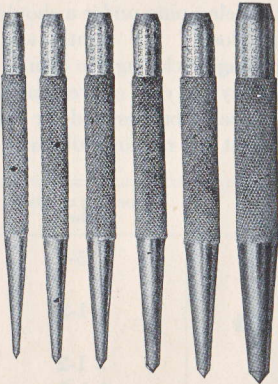
Of tool steel, carefully hardened. They are of convenient sizes, about 4" in length and are knurled to provide a good finger grip. The points are concave and the edges rounded.

No.	Diameter at Point, Inches	Price
762	A 1-16	\$0.25
	B 3-32	.25
	C 1-8	.25
	D 5-32	.25
	E 7-32	.30

Price per dozen, \$2.75

Machinists' Center Punches No. 765

These punches are of convenient sizes and knurled on the body to afford a good finger grip. Both ends are tempered, and the points carefully ground to an angle. They are about 4" in length.



No.	Diameter at Top of Tapered Point, Inches	Price
765	AA 1-16	\$0.25
	A 5-64	.25
	B 3-32	.25
	C 9-64	.25
	D 5-32	.25
	E 15-64	.25

Price per dozen, \$2.75

Each of the above packed six in a box.

## Automatic Center Punches No. 770

**Style 1, 4 1-8" long, 3-8" diameter, Price, \$2.00**

**Style 2, 5 1-4" long, 5-8" diameter, Price, \$3.00**

**Style 3, 6" long, 3-4" diameter, Price, \$4.00**



The Automatic Center Punch is more convenient for laying out work to be drilled than the ordinary center punch and hammer.

The tool is of steel, the striking mechanism being enclosed in the knurled handle, which is of such a size and form as to be held conveniently in the hand. A downward pressure releases the striking block and makes the impression. The punch marks are of uniform depth.

The points on Styles 2 and 3 can be taken out for grinding and are easily replaced if broken.

Style 1 is adapted for carrying in the pocket, and is made to meet the demand for a small, light tool suitable for the more delicate work required in tool making.

Style 3 differs from the Style 2 in being slightly heavier in construction and capable of striking a much heavier blow.

**Extra Points** for either Style 2 or 3 Punch, **Price, 20 cents each.**

Packed one in a box.

## Automatic Center Punch No. 771

**Price, \$3.50**

**Adjustable**

**5 1-4" Long, 5-8" Diameter**



The length of stroke of this Automatic Center Punch is adjustable. This feature is one that is readily appreciated by mechanics, as it adapts the tool to all varieties of tool and general shop work.

For example: If a piece of tool work is to be laid out, fine punch marks are required for the outline, but for general shop work, as centering for drills, etc., much heavier marks are necessary. The convenience of having a tool that can be readily adjusted to meet both conditions is apparent.

The adjustment of the stroke is made by the knurled thumb-screw on the top of the handle. To adjust for fine work requiring a light mark, turn the screw to the right; for coarse work, turn the screw to the left.

The points can be taken out for grinding and are easily replaced if broken.

**Extra Points, Price 20 cents each**

**Packed one in a box.**



## Spacing Attachment No. 775

Price, \$3.00

Capacity, Beam 4" Long, Swings 8"

To be used with No. 770, Style 2, and No. 771 Automatic Center Punches

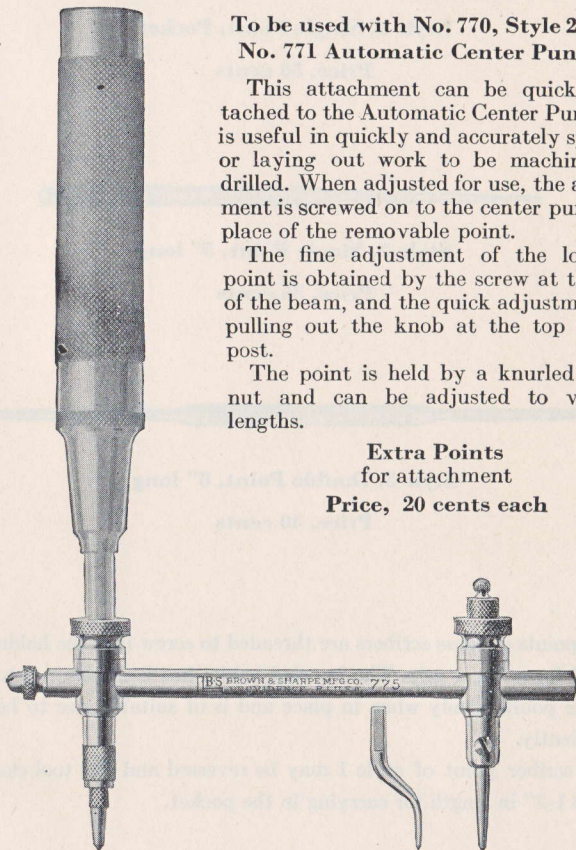
This attachment can be quickly attached to the Automatic Center Punch. It is useful in quickly and accurately spacing or laying out work to be machined or drilled. When adjusted for use, the attachment is screwed on to the center punch, in place of the removable point.

The fine adjustment of the locating point is obtained by the screw at the end of the beam, and the quick adjustment by pulling out the knob at the top of the post.

The point is held by a knurled check nut and can be adjusted to varying lengths.

Extra Points  
for attachment

Price, 20 cents each



Packed one in a box.

## Scribers No. 778



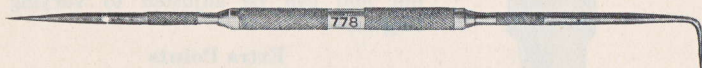
**Style 1, Single Point, Pocket**

**Price, 50 cents**



**Style 2, Single Point, 5" long**

**Price, 35 cents**



**Style 3, Double Point, 8" long**

**Price, 40 cents**

The points of these scribers are threaded to screw into the holder and knurled for a finger grip. The knurled holder has long bearings to support the points firmly when in place and is of suitable size to be held conveniently.

The scriber point of style 1 may be reversed and the tool closes to about 3 1-2" in length for carrying in the pocket.

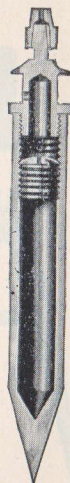
Each of the above packed six in a box.

## Mercury Plumb Bobs No. 790

An important feature is the device for fastening the string without a knot. After unwinding the required length, the cord is inserted in a slot in a taper stud, and the knurled cap, which has a taper hole, is forced over it, thus making the bob hang true.



These Plumb Bobs are made from a solid steel rod, bored out and filled with mercury, or quicksilver, which makes them unusually heavy in proportion to their size. The center of gravity is low. The cut at the right shows the manner in which these plumb bobs are constructed. The comparatively small diameters allow them to be used close to corners and walls. They are not easily affected by draughts of air and may be conveniently carried or packed in small spaces.



The points are hardened, and the bodies and points are ground. The plumb bobs are nickel plated and each is furnished with a braided silk line. The 3 1-2 oz. size can be easily carried in the vest pocket.

Weight, Ounces	Length, Inches	Diameter, Inches	Price
3 1-2	4	1-2	\$1.80
6	4 1-2	5-8	2.40
12	5 3-8	7-8	3.00
16	6	1	3.60

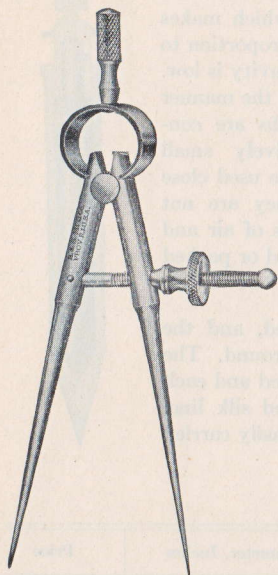
Packed one in a box.



## Toolmakers' Calipers and Dividers

**T**HE fulcrum stud is hardened. The spring is unusually stiff and of a construction that insures rigidity, prevents side deflection of the legs and gives uniform pressure. The legs are of steel, round and highly polished; the measuring points come together evenly.

Especial attention is called to the 2" sizes, as they are convenient for small, light work and for carrying in the pocket.

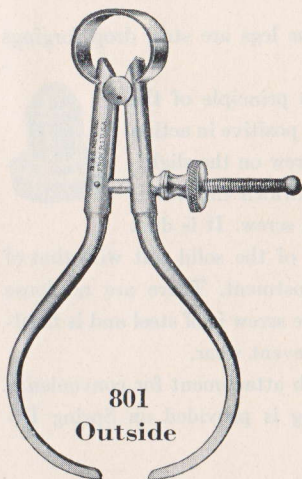


### Toolmakers' Dividers No. 800

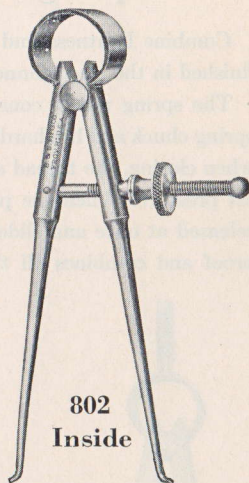
No.	Size, Inches	Price
800	2	\$1.20
	3	1.50
	4	1.80
	5	1.80
	6	2.10

Packed two in a box.

# Toolmakers' Outside and Inside Calipers Nos. 801 and 802



**801**  
**Outside**



**802**  
**Inside**

No.	Size, Inches	Price	No.	Size, Inches	Price
<b>801</b>	2	\$1.20	<b>802</b>	2	\$1.20
	3	1.50		3	1.50
	4	1.80		4	1.80
	5	1.80		5	1.80
	6	2.10		6	2.10

Each of the above packed two in a box.

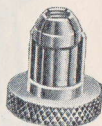
## Duplicate Parts for Toolmakers' Calipers and Dividers

Leg .....	\$0.40
Screw and Ball.....	.20
Nut.....	.15
Spring.....	.30
Spring with Thumb Attachment for Dividers.....	.50
Thumb Attachment.....	.20
Nut Washer.....	.05
Fulcrum Stud.....	.15

## Brown & Sharpe Spring Calipers and Dividers

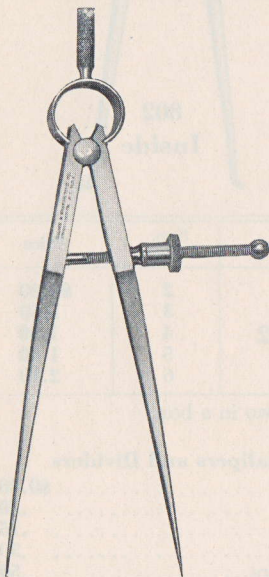
Combine lightness and durability. The legs are steel drop forgings finished in the best manner possible.

The spring nut is constructed on the principle of the spring chuck and has hardened jaws. It is positive in action when closing, the thread engaging the screw on the slightest pressure. When the pressure is withdrawn the nut is released at once and slides freely on the screw. It is dust proof and combines all the advantages of the solid nut with that of



quick adjustment. There are no loose pieces. The screw is of steel and is hardened to prevent wear.

A thumb attachment for convenience in handling is provided on Spring Dividers.



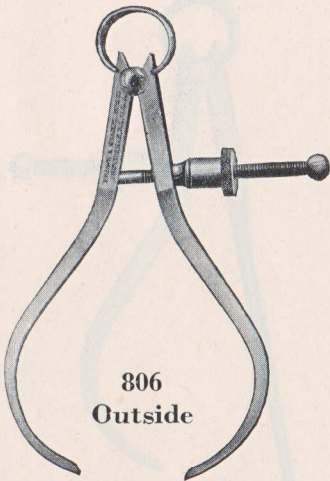
### Brown & Sharpe Spring Dividers No. 805

No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
805	2 1-2	\$1.40	\$1.20
	3	1.40	1.20
	4	1.70	1.50
	5	1.70	1.50
	6	2.10	1.95

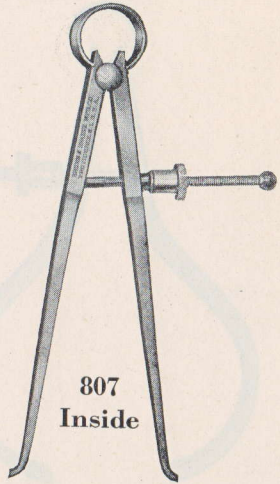
Packed two in a box.



# **Brown & Sharpe Outside and Inside Spring Calipers Nos. 806 and 807**



**806  
Outside**



**807  
Inside**

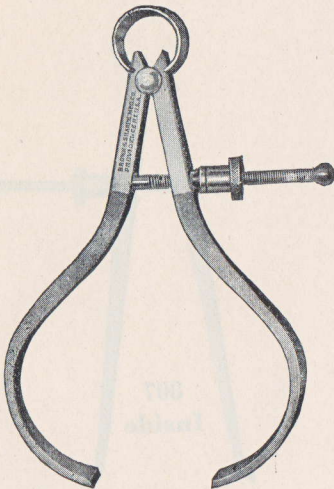
No.	Size, Inches	Price with Spring Nut	Price with Solid Nut	No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
<b>806</b>	2 1-2	\$1.40	\$1.20	<b>807</b>	3	\$1.40	\$1.20
	3	1.40	1.20		4	1.50	1.35
	4	1.50	1.35		5	1.50	1.35
	5	1.50	1.35		6	1.80	1.65
	6	1.80	1.65				

Each of the above packed two in a box.

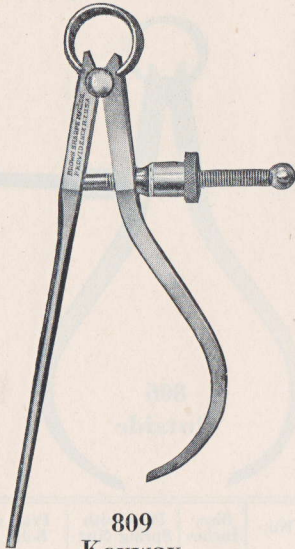
## **Duplicate Parts for Brown & Sharpe Spring Calipers and Dividers**

Leg. ....	\$0.40
Screw and Ball. ....	.20
Solid Nut. ....	.15
Spring. ....	.30
Spring with Thumb Attachment for Dividers. ....	.50
Spring Nut. ....	.30
Nut Washer. ....	.15
Thumb Attachment. ....	.20

**Brown & Sharpe Thread and Keyway  
Spring Calipers Nos. 808 and 809**



**808  
Thread**



**809  
Keyway**

No.	Size, Inches	Price with Spring Nut	Price with Solid Nut	No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
808	3	\$1.40	\$1.20	809	3	\$1.40	\$1.20
	4	1.50	1.35		4	1.50	1.30
	5	1.50	1.35				

Each of the above packed two in a box.

**Duplicate Parts for Brown & Sharpe Thread and Keyway Spring  
Calipers**

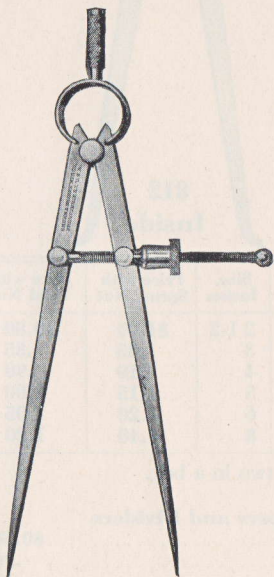
Leg.....	\$0.40
Screw and Ball.....	.20
Solid Nut.....	.15
Spring.....	.30
Spring Nut.....	.30
Nut Washer.....	.15

## Rex Spring Calipers and Dividers

**T**HESE are somewhat lighter than the Brown & Sharpe Calipers and Dividers, but the same care is taken in their construction as in the more expensive line.

The Rex Calipers are neat and attractive in appearance, and durable.

The adjusting screw is hardened to prevent wear. A thumb attachment for convenience in handling is provided on Spring Dividers.



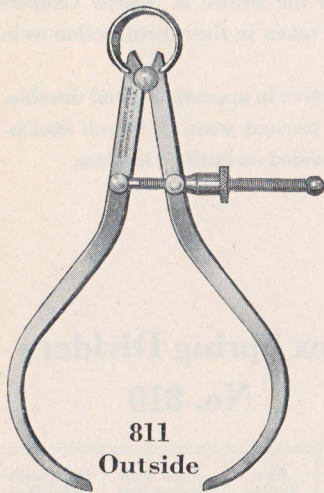
### Rex Spring Dividers No. 810

No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
810	2 1-2	\$1.00	\$0.80
	3	1.05	.85
	4	1.10	.90
	5	1.15	1.00
	6	1.20	1.05
	8	1.50	1.35

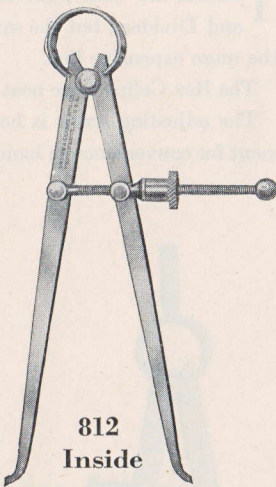
Packed two in a box.



Rex Outside and Inside Spring Calipers  
Nos. 811 and 812



811  
Outside



812  
Inside

No.	Size, Inches	Price with Spring Nut	Price with Solid Nut	No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
811	2 1-2	\$1.00	\$0.80	812	2 1-2	\$1.00	\$0.80
	3	1.05	.85		3	1.05	.85
	4	1.10	.90		4	1.10	.90
	5	1.15	1.00		5	1.15	1.00
	6	1.20	1.05		6	1.20	1.05
	8	1.40	1.20		8	1.40	1.20

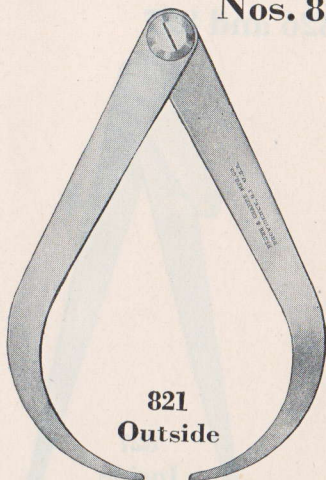
Each of the above packed two in a box.

Duplicate Parts for Rex Calipers and Dividers

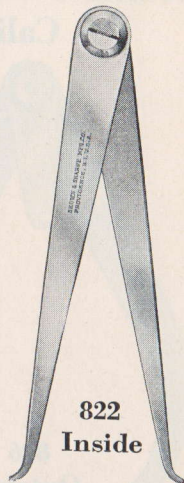
Leg.....	\$0.30
Screw and Ball.....	.20
Solid Nut .....	.15
Spring .....	.30
Spring with Thumb Attachment for Dividers.....	.50
Spring Nut ..	.30
Nut Washer .....	.15
Thumb Attachment.....	.20

# Firm-Joint Outside and Inside Calipers

## Nos. 821 and 822



**821**  
**Outside**



**822**  
**Inside**

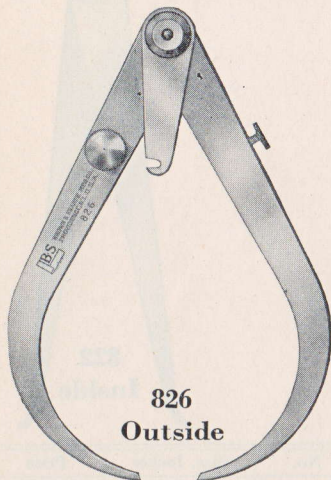
No.	Size, Inches	Price	No.	Size, Inches	Price
<b>821</b>	3	\$0.50	<b>822</b>	3	\$0.50
	4	.60		4	.60
	5	.70		5	.70
	6	.80		6	.80
	8	1.00		8	1.00
	10	1.10		10	1.10
	12	1.20		12	1.20
	14	1.80		14	1.80
	16	2.10		16	2.10
	18	2.55		18	2.55
	20	3.00		20	3.00
	24	3.60		24	3.60

Sizes above refer to length of leg. Actual capacities are as follows:

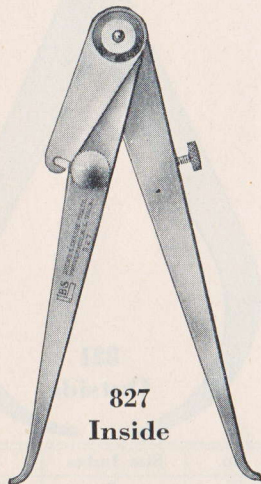
Size.....	3	4	5	6	8	10	12	14	16	18	20	24
Actual Capacity of Outside Cal- ipers.....	3 1-2	4 1-2	6	7	9 1-2	12	15	17	19	22	24 1-2	29 1-2

Each of the above packed as follows: 3", 4", 5" and 6", six; 8", 10" and 12", four; 14" and 16", two; 18", 20" and 24", one in a box.

## Transfer Firm-Joint Outside and Inside Calipers Nos. 826 and 827



**826**  
**Outside**



**827**  
**Inside**

No.	Size, Inches	Price	No.	Size, Inches	Price
<b>826</b>	4	<b>\$1.30</b>	<b>827</b>	4	<b>\$1.30</b>
	5	<b>1.50</b>		5	<b>1.50</b>
	6	<b>1.60</b>		6	<b>1.60</b>
	8	<b>1.90</b>		8	<b>1.90</b>
	10	<b>2.20</b>		10	<b>2.20</b>
	12	<b>2.50</b>		12	<b>2.50</b>
	14	<b>2.80</b>		14	<b>2.80</b>
	16	<b>3.10</b>		16	<b>3.10</b>
	18	<b>3.40</b>		18	<b>3.40</b>
	20	<b>4.00</b>		20	<b>4.00</b>
	24	<b>4.90</b>		24	<b>4.90</b>

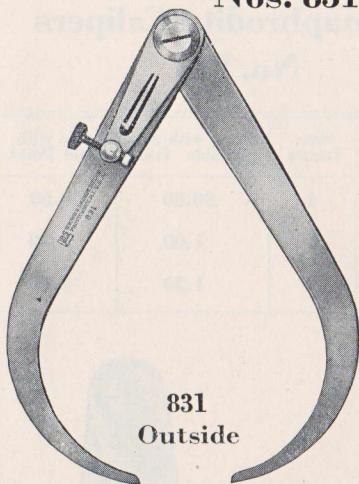
Sizes above refer to length of leg. Actual capacities are as follows:

Size .....	Inches										
	4	5	6	8	10	12	14	16	18	20	24
Actual Capacity of Outside Calipers...	4 1-2	6 7	9 1-2	12	15	17	19	22	24 1-2	29 1-2	

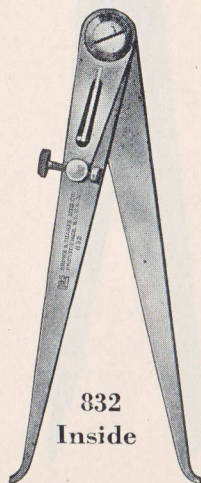
Each of the above packed as follows: 4", 5" and 6", six; 8", 10" and 12", four; 14" and 16", two; 18", 20" and 24", one in a box.



# Screw Adjusting Firm-Joint Calipers Nos. 831 and 832



**831**  
**Outside**



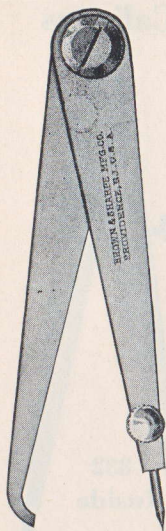
**832**  
**Inside**

No.	Size, Inches	Price	No.	Size, Inches	Price
<b>831</b>	4	\$1.10	<b>832</b>	4	\$1.10
	5	1.15		5	1.15
	6	1.20		6	1.20
	8	1.50		8	1.50
	10	1.80		10	1.80
	12	2.10		12	2.10
	14	2.40		14	2.40
	16	2.70		16	2.70
	18	3.00		18	3.00
	20	3.30		20	3.30
	24	4.20		24	4.20

Sizes above refer to length of leg. Actual capacities are as follows:

Size .....	Inches										
	4	5	6	8	10	12	14	16	18	20	24
Actual Capacity of Outside Calipers....	4 1-2	6	7	9 1-2	12	15	17	19	22	24 1-2	29 1-2

Each of the above packed as follows: 4", 5" and 6", six; 8", 10" and 12", four; 14" and 16", two; 18", 20" and 24", one in a box.



## Firm-Joint Hermaphrodite Calipers No. 835

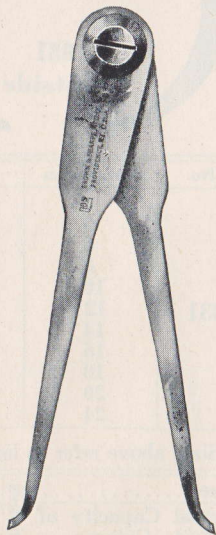
No.	Size, Inches	Price with Ad- justable Point	Price with Solid Point
835	4	\$0.80	\$0.60
	6	1.00	.80
	8	1.20	1.00

## Narrow Firm-Joint Inside Caliper No. 837

Price, 70 cents

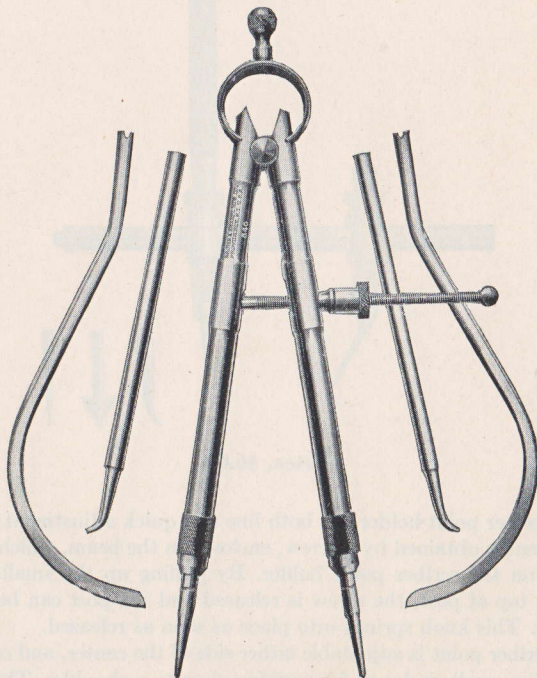
Similar in design to the regular 4" Firm-Joint Caliper, excepting that the legs are much narrower and allow it to be used to measure the diameter of deep holes at the bottom.

It can be inserted 2 1-2" in a hole 1-4" in diameter.



Each of the above packed six in a box, except 8", which is packed four in a box.

## Combination Caliper and Divider No. 840



**10 Inch**

The arms or holders are provided with split chucks to receive the auxiliary legs, which are held firmly by a turn of the knurled nut that closes the chuck concentrically. A pencil can be substituted for one of the legs if desired.

### Price

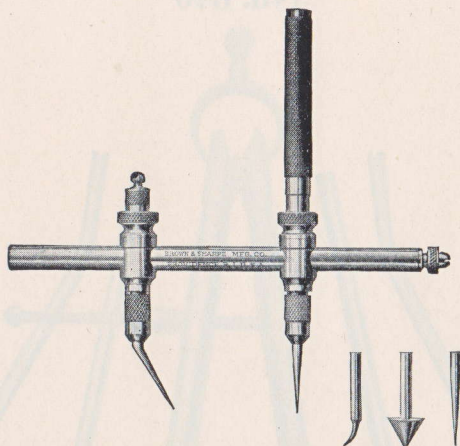
Set Complete.....\$3.60

With Divider Legs only..... 2.40

Packed one in a box.



## Universal Divider No. 843



**Price, \$6.00**

The scriber point holder has both fine and quick adjustment; the fine adjustment is obtained by a screw, enclosed in the beam, which engages the nut on the scriber point holder. By pulling up the small knurled knob, at top of post, the screw is released and the post can be quickly adjusted. This knob springs into place as soon as released.

The scriber point is adjustable either side of the center, and can be set for scribing small circles or for working close to a shoulder. The adjustable center point is held by a spring chuck and can be easily removed and replaced by a pencil or other special point. The posts are clamped by knurled nuts and held in place by spring friction when the nuts are unclamped for setting the points.

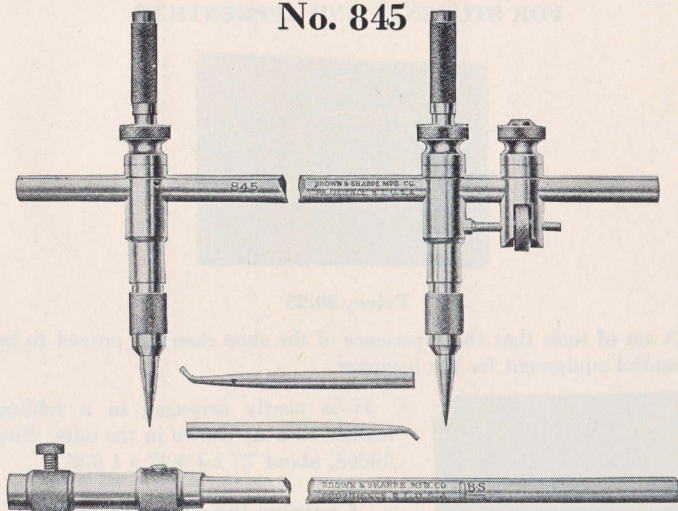
A V point is furnished for use in describing a circle about a hole already drilled. A caliper point is also included.

The beam is 4" long and the points can be set to describe a circle 8" in diameter.

Packed one in a box.

# Improved Steel Beam Trammels

## No. 845



<b>Price,</b>	<b>with 9" Beam,</b>	<b>\$6.00</b>
	Will describe a circle 18" in diam.	
<b>Price,</b>	<b>with 13" Beam,</b>	<b>\$6.00</b>
	Will describe a circle 26" in diam.	
<b>Price,</b>	<b>with 13" Beam and Extension,</b>	<b>\$7.00</b>
	Will describe a circle 54" in diam.	

The trams are clamped by knurled nuts to the beam, which is flattened on top, and the thrust taken by washers to prevent marring the bearing surfaces. A spring friction holds the trams in place when the nuts are loosened for setting. One tram has an adjusting screw and slide, which is convenient for fine adjustment of the points.

A swivel handle at the top of each tram is a noticeable advantage, as it enables the trammels to be much more conveniently and accurately used than is possible with fixed handles. The adjustable points are held by spring chucks and can be easily removed and replaced by pencil or other special points.

A pair of caliper points is furnished with these trammels.

A pair of large V points, by the use of which circles may be described around holes from 1-4" to 1 5-8" diameter, can be furnished for the 13" trammel if desired.

**Price, \$1.50 extra.**

Packed one in a box.

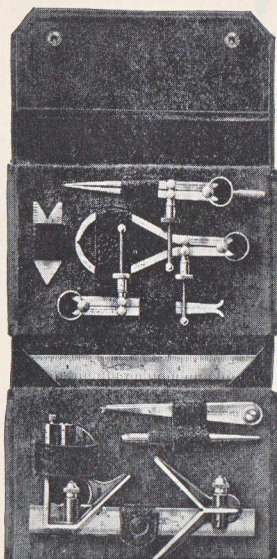
## Set of Standard Tools No. 847

### FOR STUDENTS AND APPRENTICES



**Price, \$9.25**

A set of tools that the experience of the shop man has proved to be essential equipment for the beginner.



It is neatly arranged in a folding leather case as shown in the cuts. Size folded, about 7" x 4 3-4" x 1 3-8".

#### **Contains the following tools:**

- No. 300—6" Tempered Steel Rule, No. 4 Graduation.
- No. 402—6" Combination Square, No. 4 Graduation (with hardened heads).
- No. 650—60° Center Gauge (Tempered.)
- No. 765—9-64" Center Punch.
- No. 810—4" Rex Divider, solid nut.
- No. 811—4" Rex Outside Caliper, solid nut.
- No. 812—4" Rex Inside Caliper, solid nut.
- No. 835—4" Hermaphrodite Caliper, solid point.

**Packed one set in a box.**



## Set of Standard Tools No. 849

FOR STUDENTS AND APPRENTICES

Price, \$10.00

Contains the following tools:

No. 300—6" Tempered Steel Rule, No. 4 Graduation.

No. 402—6" Combination Square, No. 4 Graduation (with hardened heads).

No. 650—60° Center Gauge (Tempered).

No. 765—Center Punch (9-64" at top of tapered point).

No. 810—5" Rex Divider, solid nut.

No. 811—6" Rex Outside Caliper, solid nut.

No. 812—6" Rex Inside Caliper, solid nut.

"Handbook for Apprenticed Machinists"

Furnished in a finished wooden box.

The "Handbook for Apprenticed Machinists" included

with the set, contains many useful hints and instructions on the proper way to perform a large variety of operations common to machine shop practice.

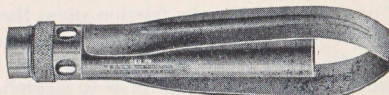
Packed one set in a box.

## Gas Heater No. 850

FOR TEMPERING DRILLS, PUNCHES, CHISELS, SMALL TOOLS, ETC.

Price, \$2.00

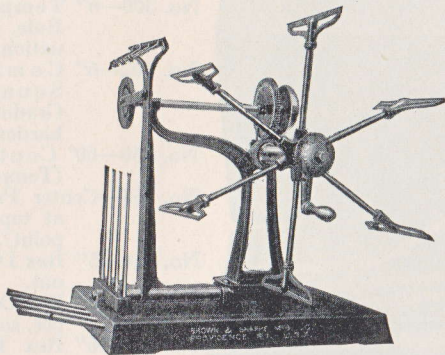
This Heater, in many instances, takes the place of a forge in tempering machinists' small tools and is more convenient and economical in time and fuel. The intensity of the flame can be controlled and regulated by turning the collar at the base of the heater.



Packed one in a box.

## Yarn Reel No. 975

FOR REELING AND MEASURING LENGTHS OF COTTON,  
WOOLEN AND WORSTED YARNS



Price, \$52.00

These Yarn Reels are especially adapted to accurate reeling of fine yarns. They are used in connection with roving scales and yarn testers when obtaining the stretch, strength and number of cotton, woollen and worsted yarns.

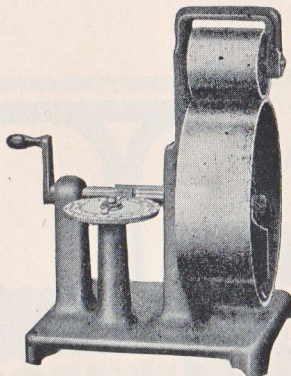
The reels are made with four or seven spindles and in two sizes, 36" and 54" in circumference.

The dial of the 36" reel is graduated into 80 parts, that of the 54" reel is graduated into 120 parts, indicating the number of yards reeled from each spindle. The number of yards reeled is indicated on the dial. The zero on the dial is located at the bright spot on the web of the worm wheel. The striking of the bell warns the operator a few turns before the zero of the dial reaches the index point. The yarn guides and spindles are kept in line with each other while feeding yarn upon the reel, which is very desirable when reeling fine yarns. The extra length of yarn guides is of use in increasing the friction upon the yarn by taking a half turn or more of yarn around them. The automatic feed motion lays the yarn flat upon the reel, thus securing accurate and uniform measurement and consequently correct results as to stretch, strength and numbering.

Printed tables are sent for use in connection with this reel, for numbering cotton, linen, woollen and worsted yarns.

## Roving Reel No. 977

TO ACCOMPANY THE ROVING OR YARN SCALES



Price, \$30.00

For reeling small quantities of roving, drawing and yarn and also to determine the number of twist in yarn.

Circumference of large drum, 18".

### Instructions for Use with the Yarn Reel

**To Find Number of Cotton Yarn.** Reel and weigh any convenient number of yards. Multiply number of yards reeled by 8 1-3, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of hanks in a pound avoirdupois.

**To Find Number of Linen Yarn.** Reel and weigh any convenient number of yards. Multiply number of yards reeled by 23 1-3, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of leas in a pound avoirdupois.

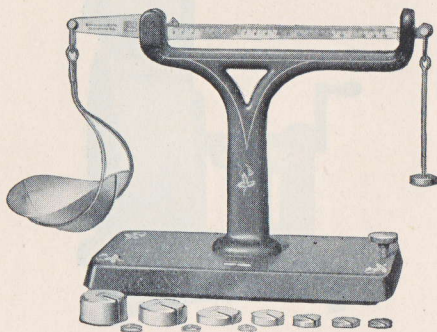
**To Find Number of Worsted Yarn.** Reel and weigh any convenient number of yards. Multiply number of yards reeled by 12 1-2, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of hanks in a pound avoirdupois.

**To Find Number of Woolen Yarn.** Reel and weigh any convenient number of yards. Multiply number of yards reeled by 4 3-8, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of runs in a pound avoirdupois.

**Note.**—In all of above calculations, the longer the length of yarn taken the more accurate will be the result.



## Improved Roving or Yarn Scales No. 980



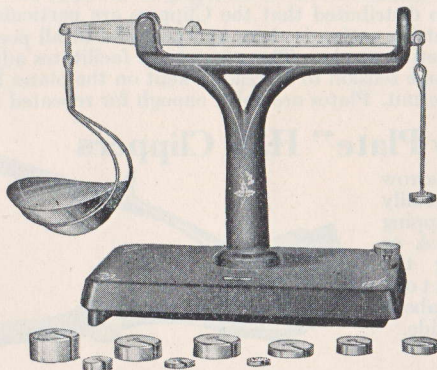
Price, \$19.00

These scales will weigh one pound by tenths of grains or one seventy-thousandth part of one pound avoirdupois, making them especially useful in connection with Yarn Reels, for the numbering of yarn from the weight of hank, giving the weight in tenths of grains to compare with tables. They are also useful for the weighing of any small articles, colors, drugs, etc., for computation of large quantities or for postal scales. The finished parts are nickel plated and the stand, japanned and ornamented. A spirit level is placed in center of base for the purpose of setting the scales true on a bench or table. Ten balancing weights accompany each scale, viz.: One each of 20, 30, 50, 100, 200, 300, 500, 1000, 2000 and 3000 grains; the 20 grains on the beam are each divided into 10 parts.

One pound avoirdupois	=	7000	grains
1-2      "              "	=	3500	"
1-4      "              "	=	1750	"
1-8      "              "	=	875	"
One ounce              "	=	437.5	"

## Sample Weighing Scales No. 982

### ENGLISH OR METRIC MEASURE



Price, \$19.00

Adapted for weighing small articles, screws, samples of paper, color, drugs, etc., for the purpose of computing large quantities. They also answer as postal scales. The finished parts are all nickel plated, and the stand is japanned and ornamented. A spirit level is placed in center of base, for the purpose of setting the scales true on a bench or table.

**English Measure Scales** weigh to one pound by ten-thousandths of a pound. Nine balancing weights are furnished of the following weights: 100, 200, 400, 800, 1000, 2000, 2000, 4000 ten-thousandths and a one-ounce weight for postal weighing.

**Metric Measure Scales** weigh to 500 grammes by hundredths of a gramme. Ten balancing weights are furnished of the following weights: 1, 2, 5, 10, 20, 40, 60, 100, 100 and 200 grammes.

7000 grains equal one pound avoirdupois.

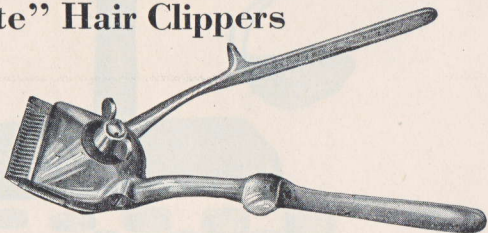
One	ten-thousandth	of a pound	equals	7-10	of a grain
156	1-4	ten-thousandths	" " "	equal	1-4 of an ounce
312	1-2	"	" " "	"	1-2 " "
468	3-4	"	" " "	"	3-4 " "
625	"	"	" " "	"	1 ounce
2500	"	"	" " "	"	1-4 of a pound
5000	"	"	" " "	"	1-2 " "
7500	"	"	" " "	"	3-4 " "

## Hair Clippers

Brown & Sharpe Hair Clippers are durable, powerful and are noteworthy for their lasting qualities, smooth cutting action and ease of operation. The handles fit the natural grip of the hand and the weight of the parts is so distributed that the Clippers are particularly well balanced. The cutting action is clean and powerful at all portions of both forward and return strokes. The winged nut facilitates adjustment and permits the same tension to be readily kept on the plates by noting the position of the nut. Plates are thick enough for repeated sharpening.

### “Narrow Plate” Hair Clippers

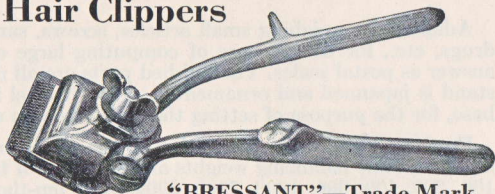
These are narrow clippers, especially useful in clipping about the neck or for trimming the beard. Bottom plates are about 1 1-2 inches wide.



No. 000	Cuts hair nearly as close as shaving.....	\$4.50
No. 00	Cuts hair one-sixty-fourth of an inch long.....	4.50

### “Bressant” Hair Clippers

The “Bressant” Hair Clipper is made in six sizes, cutting hair from 5-16ths of an inch long to nearly as close as shaving. The cutting movement is actuated by



“BRESSANT”—Trade Mark

a spiral spring contained within a screw shell. This construction permits the plates to be removed while the spring remains set. The spiral spring is practically indestructible and furnishes a uniform tension throughout the full length of stroke.

Plates are interchangeable on the “Bressant” Hair Clippers for the complete range of sizes from 000 to 3. Bottom plates are about 2 inches wide.

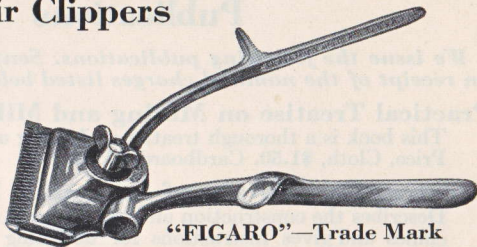
No. 000	Cuts hair nearly as close as shaving.....	\$4.50
No. 00	Cuts hair one-sixty-fourth of an inch long.....	4.50
No. 0	Cuts hair one-thirty-second of an inch long.....	4.50
No. 1	Cuts hair one-eighth of an inch long.....	4.50
No. 2	Cuts hair one-quarter of an inch long.....	5.00
No. 3	Cuts hair five-sixteenths of an inch long.....	5.50

Each of the above packed one in a box.



## “Figaro” Hair Clippers

The “Figaro” Hair Clippers are similar in design to the “Bressant,” but are lighter in weight and have smaller handles and frame. The cutting movement is actuated by the same powerful spiral spring used in the “Bressant.” In



“FIGARO”—Trade Mark

taking apart for cleaning, no wrench, screw driver or other tools are necessary. Only the nut and washer, cap, top plate and movable handle ever need be taken off by the user, the spring being free when the handle is taken off. The washer is attached to the winged nut, which prevents it being dropped or lost.

Bottom plates are about 2 inches wide.

No. 0	Cuts hair one-thirty-second of an inch long.....	\$4.50
No. 1	Cuts hair one-eighth of an inch long.....	4.50
No. 2	Cuts hair one-quarter of an inch long .....	5.00
No. 3	Cuts hair five-sixteenths of an inch long.....	5.50

Packed one in a box.

## Sharpening and Repairing

### PRICES

Sharpening clippers (our own make).....	\$0.75
Sharpening clippers (not our own make—we cannot furnish repair parts) .....	1.00
New top plate, including sharpening of clipper.....	1.35
No. 000, 00, 0 or 1 bottom plate, including sharpening of clipper...	1.75
No. 2 bottom plate, including sharpening of clipper.....	2.25
No. 3 bottom plate, including sharpening of clipper .....	2.75
New set of plates for No. 000, 00, 0 or 1 clippers.....	2.35
New set of plates for No. 2 clipper.....	2.85
New set of plates for No. 3 clipper.....	3.35
Springs for “Narrow Plate” Hair Clippers, each.....	.05
Springs for “Bressant” or “Figaro” Hair Clippers, each.....	.05

### We are Not Responsible if Teeth Break in Sharpening

If other parts are needed, they are charged extra. We have special facilities for sharpening Power and Horse Clippers.

Remittances should accompany orders. Include a sufficient amount to return clippers by **INSURED PARCEL POST**. Post Office Money Orders are most preferred.

## Publications

*We issue the following publications. Sent, postage paid, upon receipt of the nominal charges listed below:*

### **Practical Treatise on Milling and Milling Machines**

This book is a thorough treatise on Milling and Milling Machines. Price, Cloth, \$1.50. Cardboard, \$1.00.

### **Construction and Use of Automatic Screw Machines**

Describes the construction and use of our Automatic Screw Machines and gives instructions for designing and machining cams. Price, Cardboard, \$1.00.

### **Construction and Use of Universal Grinding Machines**

Describes the construction and use of our Universal Grinding Machines, and is fully illustrated. Price, Cardboard, 50 cents.

### **Construction and Use of Plain Grinding Machines**

Describes the construction and use of our Plain Grinding Machines, and is fully illustrated. Price, Cardboard, 50 cents.

### **Construction and Use of the No. 13 Universal & Tool Grinding Machines**

Describes this machine, and also includes and describes numerous set-ups that can be made on it. Price, Cardboard, 50 cents.

### **Construction and Use of No. 2 Cutter Grinding Machines and No. 3 Universal Cutter and Reamer Grinding Machines**

Describes the construction and use of these machines and contains directions for grinding cutters. Price, Cardboard, 50 cents.

### **Care and Use of Automatic Gear Cutting Machines**

Contains a description of our Automatic Gear Cutting Machines, together with instructions for care and use and for cutting spur and bevel gears. Price, Cardboard, 50 cents.

### **Practical Treatise on Gearing**

Contains tables and illustrations, and is written for those who wish to obtain practical explanations and descriptions for making gears. Price, Cloth, \$1.50. Cardboard, \$1.00.

### **Formulas in Gearing**

This work supplements the "Practical Treatise on Gearing," and contains formulas for gearing problems. Price, Cloth, \$1.50.

### **Hand Book for Apprenticed Machinists**

This book is written to assist the learner in the use of machine and machinists' tools. Price, Cloth, 50 cents.

## French or Metric Measures

The metric unit of length is the metre = 39.37 inches.

The metric unit of weight is the gramme = 15.432 grains.

The following prefixes are used for sub-divisions and multiples:

Milli =  $\frac{1}{1000}$ , Centi =  $\frac{1}{100}$ , Deci =  $\frac{1}{10}$ , Deca = 10, Hecto = 100, Kilo = 1000, Myria = 10,000.

## French and British (and American) Equivalent Measures

### MEASURES OF LENGTH

<i>French</i>	<i>British and United States</i>
1 metre	= 39.37 inches, or 3.28083 feet, 1.09361 yards
.3048 metre	= 1 foot
1 centimetre	= .3937 inch
2.54 centimetres	= 1 inch
1 millimetre	= .03937 inch, or nearly 1-25 inch
25.4 millimetres	= 1 inch
1 kilometre	= 1093.61 yards, or 0.62137 mile

### MEASURES OF WEIGHT

<i>French</i>	<i>British and United States</i>
1 gramme	= 15.432 grains
.0648 gramme	= 1 grain
28.35 grammes	= 1 ounce avoirdupois
1 kilogramme	= 2.2046 pounds
.4536 kilogramme	= 1 pound
1 tonne or metric ton	} = { .9842 ton of 2240 pounds 19.68 cwt. 2204.6 pounds
1000 kilogrammes	
1.016 metric tons	} = 1 ton of 2240 pounds
1016 kilogrammes	

### MEASURES OF CAPACITY

<i>French</i>	<i>British and United States</i>
1 litre (= 1 cubic decimetre)	= { 61.023 cubic inches .03531 cubic foot .2642 gal. (American) 2.202 lbs. of water at 62° F.
28.317 litres . . . .	= 1 cubic foot
4.543 litres . . . .	= 1 gallon (British)
3.785 litres . . . .	= 1 gallon (American)



## Decimal Equivalents of Parts of an Inch

1-64 .01563 1-32 .03125 3-64 .04688 1-16 .0625	21-64 .32813 11-32 .34375 23-64 .35938 3-8 .375	45-64 .70313 23-32 .71875 47-64 .73438 3-4 .75
5-64 .07813 3-32 .09375 7-64 .10938 1-8 .125	25-64 .39063 13-32 .40625 27-64 .42188 7-16 .4375	49-64 .76563 25-32 .78125 51-64 .79688 13-16 .8125
9-64 .14063 5-32 .15625 11-64 .17188 3-16 .1875	29-64 .45313 15-32 .46875 31-64 .48438 1-2 .5	53-64 .82813 27-32 .84375 55-64 .85938 7-8 .875
13-64 .20313 7-32 .21875 15-64 .23438 1-4 .25	33-64 .51563 17-32 .53125 35-64 .54688 9-16 .5625	57-64 .89063 29-32 .90625 59-64 .92188 15-16 .9375
17-64 .26563 9-32 .28125 19-64 .29688 5-16 .3125	37-64 .57813 19-32 .59375 39-64 .60938 5-8 .625	61-64 .95313 31-32 .96875 63-64 .98438 1 1.00000
	41-64 .64063 21-32 .65625 43-64 .67188 11-16 .6875	

## Millimetre Equivalents of Parts of an Inch

Inches	m/m	Inches	m/m	Inches	m/m
1-64 .397		21-64 8.334		45-64 17.859	
1-32 .794		11-32 8.731		23-32 18.256	
3-64 1.191		23-64 9.128		47-64 18.653	
1-16 1.587		3-8 9.525		3-4 19.050	
5-64 1.984		25-64 9.922		49-64 19.447	
3-32 2.381		13-32 10.319		25-32 19.844	
7-64 2.778		27-64 10.716		51-64 20.240	
1-8 3.175		7-16 11.113		13-16 20.637	
9-64 3.572		29-64 11.509		53-64 21.034	
5-32 3.969		15-32 11.906		27-32 21.431	
11-64 4.366		31-64 12.303		55-64 21.828	
3-16 4.762		1-2 12.700		7-8 22.225	
13-64 5.159		33-64 13.097		57-64 22.622	
7-32 5.556		17-32 13.494		29-32 23.019	
15-64 5.953		35-64 13.890		59-64 23.415	
1-4 6.350		9-16 14.287		15-16 23.812	
17-64 6.747		37-64 14.684		61-64 24.209	
9-32 7.144		19-32 15.081		31-32 24.606	
19-64 7.541		39-64 15.478		63-64 25.003	
5-16 7.937		5-8 15.875		1 25.400	
		41-64 16.272			
		21-32 16.669			
		43-64 17.065			
		11-16 17.462			

## Decimal Equivalents of Millimetres and Fractions of Millimetres

m/m	Inches	m/m	Inches	m/m	Inches	m/m	Inches
1-100 = .00039		33-100 = .01299		64-100 = .02520		95-100 = .03740	
2-100 = .00079		34-100 = .01339		65-100 = .02559		96-100 = .03780	
3-100 = .00118		35-100 = .01378		66-100 = .02598		97-100 = .03819	
4-100 = .00157		36-100 = .01417		67-100 = .02638		98-100 = .03858	
5-100 = .00197		37-100 = .01457		68-100 = .02677		99-100 = .03898	
6-100 = .00236		38-100 = .01496		69-100 = .02717	1	= .03937	
7-100 = .00276		39-100 = .01535		70-100 = .02756	2	= .07874	
8-100 = .00315		40-100 = .01575		71-100 = .02795	3	= .11811	
9-100 = .00354		41-100 = .01614		72-100 = .02835	4	= .15748	
10-100 = .00394		42-100 = .01654		73-100 = .02874	5	= .19685	
11-100 = .00433		43-100 = .01693		74-100 = .02913	6	= .23622	
12-100 = .00472		44-100 = .01732		75-100 = .02953	7	= .27559	
13-100 = .00512		45-100 = .01772		76-100 = .02992	8	= .31496	
14-100 = .00551		46-100 = .01811		77-100 = .03032	9	= .35433	
15-100 = .00591		47-100 = .01850		78-100 = .03071	10	= .39370	
16-100 = .00630		48-100 = .01890		79-100 = .03110	11	= .43307	
17-100 = .00669		49-100 = .01929		80-100 = .03150	12	= .47244	
18-100 = .00709		50-100 = .01969		81-100 = .03189	13	= .51181	
19-100 = .00748		51-100 = .02008		82-100 = .03228	14	= .55118	
20-100 = .00787		52-100 = .02047		83-100 = .03268	15	= .59055	
21-100 = .00827		53-100 = .02087		84-100 = .03307	16	= .62992	
22-100 = .00866		54-100 = .02126		85-100 = .03346	17	= .66929	
23-100 = .00906		55-100 = .02165		86-100 = .03386	18	= .70866	
24-100 = .00945		56-100 = .02205		87-100 = .03425	19	= .74803	
25-100 = .00984		57-100 = .02244		88-100 = .03465	20	= .78740	
26-100 = .01024		58-100 = .02283		89-100 = .03504	21	= .82677	
27-100 = .01063		59-100 = .02323		90-100 = .03543	22	= .86614	
28-100 = .01102		60-100 = .02362		91-100 = .03583	23	= .90551	
29-100 = .01142		61-100 = .02402		92-100 = .03622	24	= .94488	
30-100 = .01181		62-100 = .02441		93-100 = .03661	25	= .98425	
31-100 = .01220		63-100 = .02480		94-100 = .03701	26	= 1.02362	
32-100 = .01260		.....		.....		.....	



# Weight of Square and Round Bars of Steel

## IN POUNDS PER LINEAR FOOT

Based on 489.6 lbs. per cubic foot. For Wrought Iron deduct 2 per cent.

Thickness or Diameter, Inches	Weight of Square Bar 1 foot long	Weight of Round Bar 1 foot long	Thickness or Diameter, Inches	Weight of Square Bar 1 foot long	Weight of Round Bar 1 foot long
1-32	.0033	.0026	2 1-2	21.25	16.69
1-16	.0133	.0104	9-16	22.33	17.53
1-8	.0531	.0417	5-8	23.43	18.40
3-16	.1195	.0938	11-16	24.56	19.29
1-4	.2123	.1669	3-4	25.00	20.20
5-16	.3333	.2608	13-16	26.90	21.12
3-8	.4782	.3756	7-8	28.10	22.07
7-16	.6508	.5111	15-16	29.34	23.04
1-2	.8500	.6676	3	30.60	24.03
9-16	1.076	.8449	1-16	31.89	25.04
5-8	1.328	1.043	1-8	33.20	26.08
11-16	1.608	1.262	3-16	34.55	27.13
3-4	1.913	1.502	1-4	35.92	28.20
13-16	2.245	1.763	5-16	37.31	29.30
7-8	2.603	2.044	3-8	38.73	30.42
15-16	2.989	2.347	7-16	40.18	31.56
1	3.400	2.670	1-2	41.65	32.71
1-16	3.838	3.014	9-16	43.14	33.90
1-8	4.303	3.379	5-8	44.68	35.09
3-16	4.795	3.766	11-16	46.24	36.31
1-4	5.312	4.173	3-4	47.82	37.56
5-16	5.857	4.600	13-16	49.42	38.81
3-8	6.428	5.019	7-8	51.05	40.10
7-16	7.026	5.518	15-16	52.71	41.40
1-2	7.650	6.008	4	54.40	42.73
9-16	8.301	6.520	1-16	56.11	44.07
5-8	8.978	7.051	1-8	57.85	45.44
11-16	9.682	7.604	3-16	59.62	46.83
3-4	10.41	8.178	1-4	61.41	48.24
13-16	11.17	8.773	5-16	63.23	49.66
7-8	11.95	9.388	3-8	65.08	51.11
15-16	12.76	10.02	7-16	66.95	52.58
2	13.60	10.68	1-2	68.85	54.07
1-16	14.46	11.36	9-16	70.78	55.59
1-8	15.35	12.06	5-8	73.73	57.12
3-16	16.27	12.78	11-16	74.70	58.67
1-4	17.22	13.52	3-4	76.71	60.25
5-16	18.19	14.28	13-16	78.74	61.84
3-8	19.18	15.07	7-8	80.81	63.46
7-16	20.20	15.86	15-16	82.89	65.10

*Continued on next page.*

# Weight of Square and Round Bars of Steel

## IN POUNDS PER LINEAR FOOT

Based on 489.6 lbs. per cubic foot. For Wrought Iron deduct 2 per cent.

Thickness or Diameter, Inches	Weight of Square Bar 1 foot long	Weight of Round Bar 1 foot long	Thickness or Diameter, Inches	Weight of Square Bar 1 foot long	Weight of Round Bar 1 foot long
5	85.00	66.76	7	166.6	130.9
1-16	87.14	68.44	1-8	172.6	135.6
1-8	89.30	70.14	1-4	178.7	140.4
3-16	91.49	71.86	3-8	184.9	145.3
1-4	93.72	73.60	1-2	191.3	150.2
5-16	95.96	75.37	5-8	197.7	155.2
3-8	98.23	77.15	3-4	204.2	160.3
7-16	100.5	78.95	7-8	210.8	165.6
1-2	102.8	80.77	8	217.6	171.0
9-16	105.2	82.62	1-8	224.5	176.3
5-8	107.6	84.49	1-4	231.4	181.8
11-16	110.0	86.38	3-8	238.5	187.3
3-4	112.4	88.29	1-2	245.6	193.0
13-16	114.9	90.22	5-8	252.9	198.7
7-8	117.4	92.17	3-4	260.3	204.4
15-16	119.9	94.14	7-8	267.9	210.3
6	122.4	96.14	9	275.4	216.3
1-16	125.0	98.14	1-8	283.2	222.4
1-8	127.6	100.2	1-4	291.1	228.5
3-16	130.2	102.2	3-8	298.9	234.7
1-4	132.8	104.3	1-2	306.8	241.0
5-16	135.5	106.4	5-8	315.0	247.4
3-8	138.2	108.5	3-4	323.2	253.9
7-16	140.9	110.7	7-8	331.6	260.4
1-2	143.6	112.8	10	340.0	267.0
9-16	146.5	114.9	1-4	357.2	280.6
5-8	149.2	117.2	1-2	374.9	294.4
11-16	152.1	119.4	3-4	392.9	308.6
3-4	154.9	121.7	11	411.4	323.1
13-16	157.8	123.9	1-4	430.3	337.9
7-8	160.8	126.2	1-2	449.6	353.1
15-16	163.6	128.5	3-4	469.4	368.6

To compute the weight of Sheet Steel:

Multiply the thickness by 40.8; the result is the weight in pounds per square foot.

Example: A piece of Sheet Steel is .005" thick, its weight is  $.005 \times 40.8 = .204$  lbs. per square foot.

To compute the weight of Sheet Iron:

Multiply the thickness by 40; the result is the weight in pounds per square foot.

Example: A piece of Sheet Iron is .005" thick, its weight is  $.005 \times 40 = .200$  lbs. per square foot.

# Weight of Iron and Steel Sheets—*Kent*

## Thickness by Birmingham Gauge

No. of Gauge	Thickness, Inches	Weight per Sq. Ft.	
		Iron	Steel
0000	.454	18.16	18.52
000	.425	17.00	17.34
00	.38	15.20	15.30
0	.34	13.60	13.87
1	.3	12.00	12.24
2	.284	11.36	11.59
3	.259	10.36	10.57
4	.238	9.52	9.71
5	.22	8.80	8.98
6	.203	8.12	8.28
7	.18	7.20	7.34
8	.165	6.60	6.73
9	.148	5.92	6.04
10	.134	5.36	5.47
11	.12	4.80	4.90
12	.109	4.36	4.45
13	.095	3.80	3.88
14	.083	3.32	3.39
15	.072	2.88	2.94
16	.065	2.60	2.65
17	.058	2.32	2.37
18	.049	1.96	2.00
19	.042	1.68	1.71
20	.035	1.40	1.43
21	.032	1.28	1.31
22	.028	1.12	1.14
23	.025	1.00	1.02
24	.022	.88	.898
25	.02	.80	.816
26	.018	.72	.734
27	.016	.64	.653
28	.014	.56	.571
29	.013	.52	.530
30	.012	.48	.490
31	.01	.40	.408
32	.009	.36	.367
33	.008	.32	.326
34	.007	.28	.286
35	.005	.20	.204

## Thickness by American (Brown & Sharpe's) Gauge

No. of Gauge	Thickness, Inches	Weight per Sq. Ft.	
		Iron	Steel
0000	.46	18.40	18.77
000	.4096	16.38	16.71
00	.3648	14.59	14.88
0	.3249	13.00	13.26
1	.2893	11.57	11.80
2	.2576	10.30	10.51
3	.2294	9.18	9.36
4	.2043	8.17	8.34
5	.1819	7.28	7.42
6	.1620	6.48	6.61
7	.1443	5.77	5.89
8	.1285	5.14	5.24
9	.1144	4.58	4.67
10	.1019	4.08	4.16
11	.0907	3.63	3.70
12	.0808	3.23	3.30
13	.0720	2.88	2.94
14	.0641	2.56	2.62
15	.0571	2.28	2.33
16	.0508	2.03	2.07
17	.0453	1.81	1.85
18	.0403	1.61	1.64
19	.0359	1.44	1.46
20	.0320	1.28	1.31
21	.0285	1.14	1.16
22	.0253	1.01	1.03
23	.0226	.904	.922
24	.0201	.804	.820
25	.0179	.716	.730
26	.0159	.636	.649
27	.0142	.568	.579
28	.0126	.504	.514
29	.0113	.452	.461
30	.0100	.400	.408
31	.0089	.356	.363
32	.0080	.320	.326
33	.0071	.284	.290
34	.0063	.252	.257
35	.0056	.224	.228

Specific gravity.....Iron 7.7 Steel 7.854  
 Weight per cubic foot....." 480. " 489.6  
 Weight per cubic inch....." .2778 " .2833

As many gauges differ, and even the thicknesses of a certain specified gauge are not assumed the same by all manufacturers, orders for sheets and wires should always state the weight per square foot or the thickness in thousandths of an inch.



## Brown & Sharpe Standard Taper Holes

### FOR SPINDLES, COLLETS, etc.

No. of Taper	Approx. Diam. at Large End, Inches	No. of Taper	Approx. Diam. at Large End, Inches	No. of Taper	Approx. Diam. at Large End, Inches
6	19-32	10	1 1-4	14	2 11-32
7	23-32	11	1 1-2	16	2 7-8
9	1 1-16	12	1 13-16	18	3 7-16

## Brown & Sharpe Standard Tapers

### FOR SPINDLES, ARBORS, COLLETS, etc.

No. of Taper	Diam. at Small End, Inches	No. of Taper	Diam. at Small End, Inches	No. of Taper	Diam. at Small End, Inches
1	.200	7	.600	13	1.750
2	.250	8	.750	14	2.000
3	.312	9	.900	15	2.250
4	.350	10	1.0446	16	2.500
5	.450	11	1.250	17	2.750
6	.500	12	1.500	18	3.000

## The Taper-Nose Spindle

**T**HE front end of the spindle is tapered, hardened and ground, and has a recess to receive cutter driver or the clutch on arbors and collets. Arbors and collets are provided with clutches and have a threaded hole in the end of the shank. The clutch fits into the recess in the end of the spindle and the arbor or collet is drawn into place and held securely by a drawing-in bolt which passes through the center of spindle.

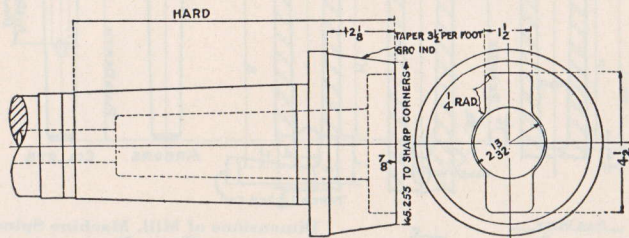
Face milling cutters are drawn directly on to the taper nose of the spindle by a cutter driver and drawing-in bolt, the former fitting a slot in the cutter and the recess in the spindle.

**Advantages.** The simplicity and fewness of parts are noteworthy. Because there are no plates, screws or loose parts, the nose of the spindle is smooth and entirely free from projections.

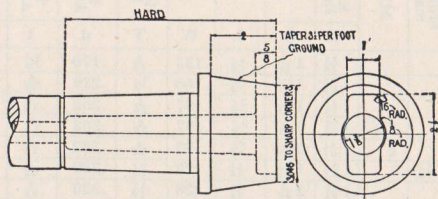
A cutter or collet once in place is practically as firm as though part of the spindle, yet can be removed with a minimum of effort. This can be best appreciated in the case of face milling cutters, no time-wasting "freezing" of cutters to spindle being possible.

The taper-nose spindle gives a steady, positive drive under the heaviest cut.

## Dimensions of the Taper-Nose Spindle on Brown & Sharpe Milling Machines



Machine	No. of Taper Hole
No. 3, 3A Universal Milling Machines No. 2B Heavy, 3, 3B, 13B Pl. M. M. and 33 Auto. M. M. No. 2, 5 Vertical Spindle Milling Machines	11 B & S
No. 3A Heavy, 4A Universal Milling Machines No. 3B Heavy, 4B Plain Milling Machines No. 3 Vertical Spindle Milling Machine	12 B & S
No. 4A Heavy Universal Milling Machine No. 4B Heavy, 5B Heavy Plain Milling Machines	14 B & S

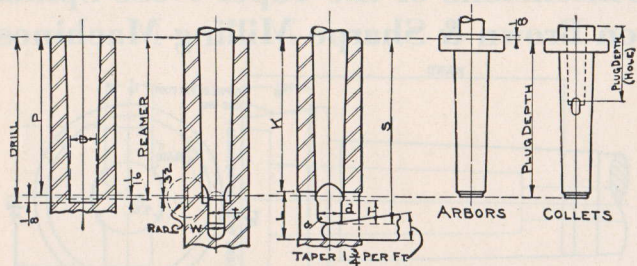


Machine	No. of Taper Hole
No. 1, 1A (with or without Back Gears), 2 & 2A Univ. M. M. No. 1, 1B (with or without Back Gears), 2 & 2B Pl. M. M. No. 1Y, 2Y, Pl. Rack Feed M. M. and 21 Auto. M. M.	10 B & S

### Dimensions of Tapped Hole in Shanks of Arbors and Collets

No. 10 Taper 1-2", 14, L. H.    Nos. 11 and 12 Taper 3-4", 12, L. H.  
No. 14 Taper 1", 10, L. H.

Brown & Sharpe Tapers



Dimensions of Mill. Machine Spindles (Taper-Nose)

A†	B	E	F	G	H	I	J
3.045	2	2½	1	1⅜	⅝	⅜	⅜
5.255	2⅛	4½	1½	2⅜	⅞	¼	¼

†Diameter at sharp corner.

Taper .500" per ft. except No. 10 which is .5161" per ft.

No. of Taper	Diam. of Plug at Small End	Plug Depth P			Keyway from End of Spindle	Shank Depth	Length of Keyway †	Width of Keyway	Length of Arbor Tongue	Diameter of Arbor Tongue	Thickness of Arbor Tongue	Radius of Tongue Circle	Radius of Tongue at a	Limit for Tongue to project thro' Test Tool
		B & S* Standard	Mill. Mach. Standard	Miscell.										
	D				K	S	L	W	T	d	t	c	a	
1	.200"	⅜			⅜	1 ⅜	⅜	.135	⅜	.170	⅜	⅜	.030	.003
2	.250"	1 ⅜			1 ⅜	1 ½	½	.166	¼	.220	⅜	⅜	.030	.003
		1 ½			1 ⅜	1 ⅜	⅝	.197	⅜	.282	⅜	⅜	.040	.003
3	.312"			1 ¾	1 ⅜	2 ⅜	⅝	.197	⅜	.282	⅜	⅜	.040	.003
				2	1 ⅜	2 ⅜	⅝	.197	⅜	.282	⅜	⅜	.040	.003
4	.350"		1 ¼		1 ⅜	1 ⅜	⅜	.228	⅜	.320	⅜	⅜	.050	.003
		1 ⅜			1 ⅜	2 ⅜	⅜	.228	⅜	.320	⅜	⅜	.050	.003
			1 ¾		1 ⅜	2 ⅜	⅜	.260	⅜	.420	¼	⅜	.060	.003
5	.450"			2	1 ⅜	2 ⅜	⅜	.260	⅜	.420	¼	⅜	.060	.003
		2 ⅜			2 ⅜	2 ⅜	⅜	.260	⅜	.420	¼	⅜	.060	.003
6	.500"	2 ⅜			2 ⅜	2 ⅜	⅜	.291	⅜	.450	⅜	⅜	.060	.005
			2 ½		2 ⅜	3 ⅜	⅜	.322	⅜	.560	⅜	⅜	.070	.005
7	.600"	2 ⅜			2 ⅜	3 ⅜	⅜	.322	⅜	.560	⅜	⅜	.070	.005
			3		2 ⅜	3 ⅜	⅜	.322	⅜	.560	⅜	⅜	.070	.005
8	.750"	3 ⅜			3 ⅜	4 ⅜	1	.353	½	.710	⅜	⅜	.080	.005

\*"B & S Standard" Plug Depths are not used in all cases.  
†Special lengths of keyway are used instead of standard lengths in some places.  
Standard lengths need not be used when keyway is for driving only and not for admitting key to force out tool.



## Brown & Sharpe Tapers (Continued)

No. of Taper	Diam. of Plug at Small End	Plug Depth P			Keyway from End of Spindle	Shank Depth	Length of Keyway†	Width of Keyway	Length of Arbor Tongue	Diameter of Arbor Tongue	Thickness of Arbor Tongue	Radius of Tongue Circle	Radius of Tongue at a	Limit for Tongue to project thro Test Tool
		B & S Standard	Mill. Mach. Standard	Miscell.										
	D				K	S	L	W	T	d	t	c	a	
9	.900		4		$3\frac{7}{8}$	$4\frac{5}{8}$	$1\frac{1}{8}$	.385	$\frac{9}{16}$	.860	$\frac{3}{8}$	$\frac{7}{16}$	.100	.005
		$4\frac{1}{4}$			$4\frac{1}{8}$	$4\frac{7}{8}$	$1\frac{1}{8}$	.385	$\frac{9}{16}$	.860	$\frac{3}{8}$	$\frac{7}{16}$	.100	.005
		5			$4\frac{3}{4}$	$5\frac{3}{4}$	$1\frac{5}{8}$	.447	$\frac{21}{32}$	1.010	$\frac{7}{16}$	$\frac{7}{16}$	.110	.005
10	1.0446		$5\frac{11}{16}$		$5\frac{17}{32}$	$6\frac{13}{32}$	$1\frac{5}{8}$	.447	$\frac{21}{32}$	1.010	$\frac{7}{16}$	$\frac{7}{16}$	.110	.005
				$6\frac{7}{32}$	$6\frac{1}{16}$	$6\frac{15}{16}$	$1\frac{5}{8}$	.447	$\frac{21}{32}$	1.010	$\frac{7}{16}$	$\frac{7}{16}$	.110	.005
		$5\frac{11}{16}$			$5\frac{23}{32}$	$6\frac{3}{16}$	$1\frac{5}{8}$	.447	$\frac{21}{32}$	1.210	$\frac{7}{16}$	$\frac{1}{2}$	.130	.005
11	1.250		$6\frac{3}{4}$		$6\frac{13}{32}$	$7\frac{3}{32}$	$1\frac{5}{8}$	.447	$\frac{21}{32}$	1.210	$\frac{7}{16}$	$\frac{1}{2}$	.130	.005
12	1.500	$7\frac{1}{8}$	$7\frac{1}{8}$		$6\frac{15}{16}$	$7\frac{1}{16}$	$1\frac{1}{2}$	.510	$\frac{3}{4}$	1.460	$\frac{1}{2}$	$\frac{1}{2}$	.150	.005
				$6\frac{1}{4}$										
13	1.750	$7\frac{3}{4}$			$7\frac{9}{16}$	$8\frac{9}{16}$	$1\frac{1}{2}$	.510	$\frac{3}{4}$	1.710	$\frac{1}{2}$	$\frac{5}{8}$	.170	.010
14	2.00	$8\frac{1}{4}$	$8\frac{1}{4}$		$8\frac{1}{32}$	$9\frac{5}{32}$	$1\frac{11}{16}$	.572	$\frac{27}{32}$	1.960	$\frac{9}{16}$	$\frac{3}{4}$	.190	.010
15	2.25	$8\frac{3}{4}$			$8\frac{17}{32}$	$9\frac{11}{32}$	$1\frac{11}{16}$	.572	$\frac{27}{32}$	2.210	$\frac{9}{16}$	$\frac{7}{8}$	.210	.010
16	2.50	$9\frac{1}{4}$			9	$10\frac{1}{4}$	$1\frac{7}{8}$	.635	$\frac{15}{8}$	2.450	$\frac{5}{8}$	1	.230	.010
17	2.75	$9\frac{3}{4}$												
18	3.00	$10\frac{1}{4}$												

## The Jarno Taper

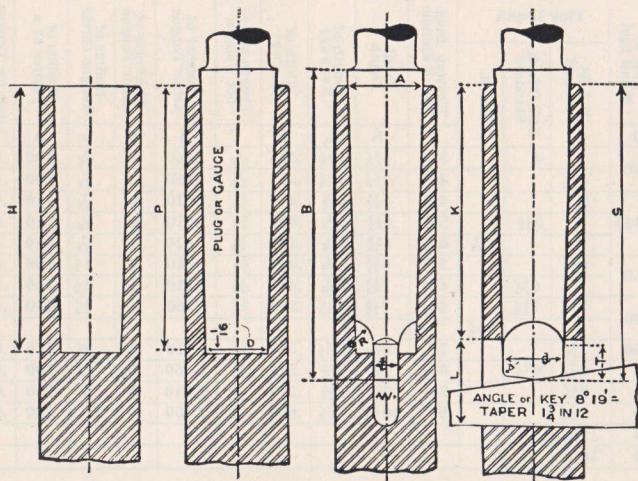
Taper per Foot = 0.6 Inch. Taper per Inch = 0.05 Inch

$$\text{Diam. Large End} = \frac{\text{No. of Taper}}{8} \quad \text{Diam. Small End} = \frac{\text{No. of Taper}}{10}$$

$$\text{Length of Taper} = \frac{\text{No. of Taper}}{2}$$

While the majority of American tool builders use the Brown & Sharpe taper in their milling machine spindles and the Morse taper in their lathes, a number of firms have adopted the "Jarno" taper. In this system, the taper of which is 0.6 inch per foot or 1 in 20, the number of the taper is the key by which all the dimensions are immediately determined. That is the number of the taper is the number of tenths of an inch in diameter at the small end, the number of eighths of an inch at the large end, and the number of halves of an inch in length or depth. For example: the No. 6 taper is six-eighths (3-4) inch diameter at large end, six-tenths (6-10) diameter at the small end and six halves (3) inches in length. Similarly, the No. 16 taper is 16-8, or 2 inches diameter at the large end; 16-10 or 1.6 inches at the small end; 16-2 or 8 inches in length.

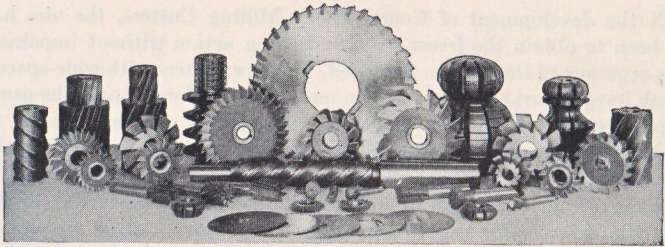
# Morse Tapers



Number of Taper	Diam. of Plug at Small End, Inches	Diam. at End of Socket, Inches	SHANK		Depth of Hole, Inches	Standard Plug Depth, Inches	TONGUE					KEYWAY			Taper per Foot	Taper per Inch	Number of Key
			Whole Length of Shank, Inches	Shank Depth, Inches			Thickness of Tongue, Inches	Length of Tongue, Inches	Rad. of Mill for Tongue, Inches	Diameter of Tongue, Inches	Radius of Tongue, Inches	Width of Keyway, Inches	Length of Keyway, Inches	End of Socket to Keyway, Inches			
	D	A	B	S	H	P	t	T	R	d	a	W	L	K			
0	.252	.3561	2 1/2	2 7/32	2 3/32	2	5/32	1/4	5/32	.235	.04	.160	1/16	1 1/8	.625	.05208	0
1	.369	.475	2 9/16	2 7/16	2 3/16	2 1/8	13/64	3/8	3/16	.343	.05	.213	3/4	2 1/16	.600	.05	1
2	.572	.700	3 7/8	2 15/16	2 5/8	2 9/16	1/4	1/16	1/4	1 1/32	.06	.260	7/8	2 1/2	.602	.05016	2
3	.778	.938	3 7/8	3 11/16	3 1/4	3 3/16	9/16	9/16	9/32	2 1/32	.08	.322	1 3/16	3 1/16	.602	.05016	3
4	1.020	1.231	4 7/8	4 5/8	4 1/8	4 1/16	15/32	5/8	5/16	3 1/32	.10	.478	1 1/4	3 7/8	.623	.05191	4
5	1.475	1.748	6 1/8	5 7/8	5 1/4	5 3/16	5/8	3/4	3/8	1 13/32	.12	.635	1 1/2	4 1/16	.630	.0525	5
6	2.116	2.494	8 9/16	8 1/4	7 3/8	7 1/4	3/4	1 1/8	1/2	2	.15	.760	1 3/4	7	.626	.05216	6
7	2.750	3.270	11 5/8	11 1/4	10 1/8	10	1 1/8	1 3/8	3/4	2 5/8	.18	1.135	2 5/8	9 1/2	.625	.05208	7



## Cutters



**WE** regularly manufacture and usually carry in stock over 45 styles and 3,000 sizes of cutters, and can make any size or shape or arrange for any combination of cutters that may be desired.

Our Cutter Department is equipped with special machinery and many appliances that are the outgrowth of over 60 years' experience in the manufacture of this class of tools.

Stocks of our regular cutters are carried by the leading hardware dealers throughout the country and can usually be purchased most advantageously from the dealers. It is also frequently advantageous to order special cutters through the dealers.

**Keep Cutters Sharpened Properly.** A dull cutter wears very rapidly and does poor work. As soon as there is any appearance of dullness in a cutter, pass it once or twice across a grinding wheel, which should be mounted upon a suitably designed machine. This in the long run will save time in sharpening, prolong the life of the cutters, and enable them to do their best and most rapid work. Formed cutters should have their teeth ground radially and so that they are all of the same height. Further information on page 291.

**Lubricant.** With all of our cutters lubricant should be freely used when milling Wrought Iron or Steel. Lard oil is usually the best; but in many cases the following Soda-Water mixture answers very well and is less expensive:

One-quarter pound Sal-Soda. One-half pint Lard Oil. One-half pint Soft Soap. Water enough to make ten quarts. Boil one-half hour.



## The Advantages of Coarse-Tooth Milling Cutters

**I**N the development of Coarse-Tooth Milling Cutters, the aim has been to obtain the freest possible cutting action without impairing the accuracy of the surface produced. The new cutters with wide-spaced teeth have a marked advantage, on many classes of work, over the usual types, being capable of removing a considerably greater quantity of metal in a given time, without distressing the cutter or overloading the machine.

The free cutting action of coarse-tooth cutters is largely due to the fact that less cutting is actually required to remove a given amount of metal, each tooth taking a large, deep chip. This results in a considerable decrease in the tendency to slide over the surface and spring the cutter arbor. The rake and increased spiral of the teeth give a more nearly perfect shearing, rather than a pushing or dragging action. Accordingly, there is less friction generated for a given cut, leaving the teeth much cooler and causing them to do considerably more work between grindings.

A marked advantage arising from the free cutting action is the consumption of less power, as might be expected from the fact that there is less friction and heating.

The wide spaces between the teeth allow the cutting edges to be well backed up, which was not always possible with closely spaced teeth. This increase in the strength of the teeth is much greater in proportion than the increase in work done by each tooth in removing the larger chips. Therefore the cutters are well prepared to handle deep and rapid cuts without danger of failing.

The main advantage of coarse-tooth milling cutters may then be stated as increased production and decreased power consumption, due to the heavier cuts taken and the freer cutting action. Of course, the amount of improvement in these points differs greatly in various instances, owing to the conditions, such as the stiffness of the work, nature of the cut, strength of the machine, etc.

In developing the line of Brown & Sharpe Coarse-Tooth Milling Cutters particular attention has been given to the angle of rake and the lead of the spiral of the teeth. After a long series of practical experiments we have adopted the present type with steep spiral and considerable angle of rake as the most economical and practical form.

## Clearance on Cutters

**W**HEN sharpening cutters, the clearance should always be taken into consideration. Clearance, or relief, on milling cutters is the amount of material removed from the top of the teeth back of the cutting edge, to permit the teeth to clear the stock and not scrape over it after the cutting edge has done its work. On formed and gear cutters, clearance does not have to be considered in re-sharpening, because the teeth are so formed that when ground radially on the faces the clearance remains the same.

The angle of clearance depends upon the diameter of the cutters and must be greater for small cutters than for large ones. The clearance on the teeth of plain milling cutters should be 4 degrees for cutters over 3 inches in diameter, and 6 degrees for those under 3 inches, and the land at the top of the teeth should be from .02 to .04-inch wide before the clearance is cut or ground. The clearance of the end teeth of end mills should be about 2 degrees, and it is well to have the teeth a little hollowing, letting them be .001 or .002-inch lower near the center than at the outside, so that the inner ends of the teeth will not drag on the work. This can be done by setting the swivel on the cutter grinder slightly away from 90 degrees. If the clearance of a cutter is too great, vibrations are likely to occur in operation, and this is something that should be prevented by all means.

See Cutter Clearance Gauge on page 398.

## Feeds and Speeds

**T**HE Feeds and Speeds of cutters cannot be governed by any definite rules, but, in a general way, the following surface speeds will serve to give an idea, or basis, to work from. They may be varied slightly to suit the requirements of the work in hand. Using Carbon Steel Cutters: For brass, 80 feet to 100 feet per minute; for cast iron, 40 feet to 60 feet per minute; for machinery steel, 30 feet to 40 feet per minute; and for annealed tool steel, 20 feet to 30 feet per minute have been found satisfactory. With High-Speed Steel Cutters for the same materials, the following speeds are advocated: For brass, 150 feet to 200 feet per minute; for cast iron, 80 feet to 100 feet per minute; for machinery steel, 80 feet to 100 feet per minute; and for annealed tool steel, 60 feet to 80 feet per minute.

Tables for determining the number of revolutions per minute to obtain the more common surface speeds of cutters of different diameters will be found on pages 242 and 243.



# Table of Cutting Speeds

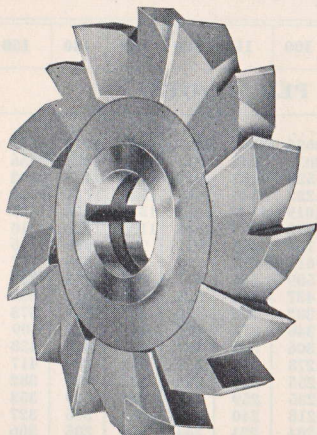
Feet per Minute	15	17.5	20	22.5	25	27.5	30	35	40	45	50	55
Diam., Inches	REVOLUTIONS PER MINUTE											
1-16	917	1070	1222	1375	1528	1681	1833	2139	2445	2750	3056	3361
1-8	458	535	611	688	764	840	917	1070	1222	1375	1528	1681
3-16	306	357	407	458	509	560	611	713	815	917	1019	1120
1-4	229	267	306	344	382	420	458	535	611	688	764	840
5-16	183	214	244	275	306	336	367	428	489	550	611	672
3-8	153	178	204	229	255	280	306	357	407	458	509	560
7-16	131	153	175	196	218	240	262	306	349	393	437	480
1-2	115	134	153	172	191	210	229	267	306	344	382	420
5-8	91.7	107	122	138	153	168	183	214	244	275	306	336
3-4	76.4	89.1	102	115	127	140	153	178	204	229	255	280
7-8	65.5	76.4	87.3	98.2	109	120	131	153	175	196	218	240
1	57.3	66.3	76.4	85.9	95.5	105	115	134	153	172	191	210
1 1-8	50.9	59.4	67.9	76.4	84.9	93.4	102	119	136	153	170	187
1 1-4	45.8	53.5	61.1	68.8	76.4	84.0	91.7	107	122	138	153	168
1 3-8	41.7	48.6	55.6	62.5	69.5	76.4	83.3	97.2	111	125	139	153
1 1-2	38.2	44.6	50.9	57.3	63.7	70.0	76.4	89.1	102	115	127	140
1 5-8	35.3	41.1	47.0	52.9	58.8	64.6	70.5	82.3	94.0	106	118	129
1 3-4	32.7	38.2	43.7	49.1	54.6	60.0	65.5	76.4	87.3	98.2	109	120
1 7-8	30.6	35.7	40.7	45.8	50.9	56.0	61.1	71.3	81.5	91.7	102	112
2	28.7	33.4	38.2	43.0	47.7	52.5	57.3	66.8	76.4	85.9	95.5	105
2 1-4	25.5	29.7	34.0	38.2	42.4	46.7	50.9	59.4	67.9	76.4	84.9	93.4
2 1-2	22.9	26.7	30.6	34.4	38.2	42.0	45.8	53.5	61.1	68.8	76.4	84.0
2 3-4	20.8	24.3	27.8	31.3	34.7	38.2	41.7	48.6	55.6	62.5	69.5	76.4
3	19.1	22.3	25.5	28.6	31.8	35.0	38.2	44.6	50.9	57.3	63.7	70.0
3 1-4	17.6	20.6	23.5	26.4	29.4	32.3	35.3	41.1	47.0	52.9	58.8	64.6
3 1-2	16.4	19.1	21.8	24.5	27.3	30.0	32.7	38.2	43.7	49.1	54.6	60.0
3 3-4	15.3	17.8	20.4	22.9	25.5	28.0	30.6	35.7	40.7	45.8	50.9	56.0
4	14.3	16.7	19.1	21.5	23.9	26.3	28.7	33.4	38.2	43.0	47.7	52.5
4 1-2	12.7	14.9	17.0	19.1	21.2	23.3	25.5	29.7	34.0	38.2	42.4	46.7
5	11.5	13.4	15.3	17.2	19.1	21.0	22.9	26.7	30.6	34.4	38.2	42.0
5 1-2	10.4	12.2	13.9	15.6	17.4	19.1	20.8	24.3	27.8	31.3	34.7	38.2
6	9.5	11.1	12.7	14.3	15.9	17.5	19.1	22.3	25.5	28.6	31.8	35.0
6 1-2	8.8	10.3	11.8	13.2	14.7	16.2	17.6	20.6	23.5	26.4	29.4	32.3
7	8.2	9.5	10.9	12.3	13.6	15.0	16.4	19.1	21.8	24.5	27.3	30.0
7 1-2	7.6	8.9	10.2	11.5	12.7	14.0	15.3	17.8	20.4	22.9	25.5	28.0
8	7.2	8.4	9.5	10.7	11.9	13.1	14.3	16.7	19.1	21.5	23.9	26.3
8 1-2	6.7	7.9	9.0	10.1	11.2	12.4	13.5	15.7	18.0	20.2	22.5	24.7
9	6.4	7.4	8.5	9.5	10.6	11.7	12.7	14.9	17.0	19.1	21.2	23.3
9 1-2	6.0	7.0	8.0	9.1	10.1	11.1	12.1	14.1	16.1	18.1	20.1	22.1
10	5.7	6.7	7.6	8.6	9.5	10.5	11.5	13.4	15.3	17.2	19.1	21.0
11	5.2	6.1	6.9	7.8	8.7	9.5	10.4	12.2	13.9	15.6	17.4	19.1
12	4.8	5.6	6.4	7.2	8.0	8.8	9.5	11.1	12.7	14.3	15.9	17.5
13	4.4	5.1	5.9	6.6	7.3	8.1	8.8	10.3	11.8	13.2	14.7	16.2
14	4.1	4.8	5.5	6.1	6.8	7.5	8.2	9.5	10.9	12.3	13.6	15.0
15	3.8	4.5	5.1	5.7	6.4	7.0	7.6	8.9	10.2	11.5	12.7	14.0
16	3.6	4.2	4.8	5.4	6.0	6.6	7.2	8.4	9.5	10.7	11.9	13.1
17	3.4	3.9	4.5	5.1	5.6	6.2	6.7	7.9	9.0	10.1	11.2	12.4
18	3.2	3.7	4.2	4.8	5.3	5.8	6.4	7.4	8.5	9.5	10.6	11.7
Feet per Minute	15	17.5	20	22.5	25	27.5	30	35	40	45	50	55



# Table of Cutting Speeds (Continued)

Feet per Minute	60	65	70	75	80	90	100	110	120	130	140	150
Diam., Inches	REVOLUTIONS PER MINUTE											
1-16	3667	3973	4278	4584	4889	...	...	...	...	...	...	...
1-8	1833	1986	2139	2292	2445	2750	3056	3361	3667	3973	4278	4584
3-16	1222	1324	1426	1528	1630	1833	2037	2241	2445	2648	2852	3056
1-4	917	993	1070	1146	1222	1375	1528	1681	1833	1986	2139	2292
5-16	733	794	856	917	978	1100	1222	1345	1467	1589	1711	1833
3-8	611	662	713	764	815	917	1019	1120	1222	1324	1426	1528
7-16	524	568	611	655	698	786	873	960	1048	1135	1222	1310
1-2	458	497	535	573	611	688	764	840	917	993	1070	1146
5-8	367	397	428	458	489	550	611	672	733	794	856	917
3-4	306	331	357	382	407	458	509	560	611	662	713	764
7-8	262	284	306	327	349	393	437	480	524	568	611	655
1	229	248	267	287	306	344	382	420	458	497	535	573
11-8	204	221	238	255	272	306	340	373	407	441	475	509
11-4	183	199	214	229	244	275	306	336	367	397	428	458
13-8	167	181	194	208	222	250	278	306	333	361	389	417
11-2	153	166	178	191	204	229	255	280	306	331	357	382
15-8	141	153	165	176	188	212	235	259	282	306	329	353
13-4	131	142	153	164	175	196	218	240	262	284	306	327
17-8	122	132	143	153	163	183	204	224	244	265	285	306
2	115	124	134	143	153	172	191	210	229	248	267	287
21-4	102	110	119	127	136	153	170	187	204	221	238	255
21-2	91.7	99.3	107	115	122	138	153	168	183	199	214	229
23-4	83.3	90.3	97.2	104	111	125	139	153	167	181	194	208
3	76.4	82.8	89.1	95.5	102	115	127	140	153	166	178	191
31-4	70.5	76.4	82.3	88.2	94.0	106	118	129	141	153	165	176
31-2	65.5	70.9	76.4	81.9	87.3	98.2	109	120	131	142	153	164
33-4	61.1	66.2	71.3	76.4	81.5	91.7	102	112	122	132	143	153
4	57.3	62.1	66.8	71.6	76.4	85.9	95.5	105	115	124	134	143
41-2	50.9	55.2	59.4	63.6	67.9	76.4	84.9	93.4	102	110	119	127
5	45.8	49.7	53.5	57.3	61.1	68.8	76.4	84.0	91.7	99.3	107	115
51-2	41.7	45.1	48.6	52.1	55.6	62.5	69.5	76.4	83.3	90.3	97.2	104
6	38.2	41.4	44.6	47.8	50.9	57.3	63.7	70.0	76.4	82.8	89.1	95.5
61-2	35.3	38.2	41.1	44.1	47.0	52.9	58.8	64.6	70.5	76.4	82.3	88.2
7	32.7	35.5	38.2	40.9	43.7	49.1	54.6	60.0	65.5	70.9	76.4	81.9
71-2	30.6	33.1	35.7	38.2	40.7	45.8	50.9	56.0	61.1	66.2	71.3	76.4
8	28.7	31.0	33.4	35.8	38.2	43.0	47.7	52.5	57.3	62.1	66.8	71.6
81-2	27.0	29.2	31.5	33.7	36.0	40.4	44.9	49.4	53.9	58.4	62.9	67.4
9	25.5	27.6	29.7	31.8	34.0	38.2	42.4	46.7	50.9	55.2	59.4	63.6
91-2	24.1	26.1	28.2	30.2	32.2	36.2	40.2	44.2	48.3	52.3	56.3	60.3
10	22.9	24.8	26.7	28.7	30.6	34.4	38.2	42.0	45.8	49.7	53.5	57.3
11	20.8	22.6	24.3	26.0	27.8	31.3	34.7	38.2	41.7	45.1	48.6	52.1
12	19.1	20.7	22.3	23.9	25.5	28.6	31.8	35.0	38.2	41.4	44.6	47.8
13	17.6	19.1	20.6	22.0	23.5	26.4	29.4	32.3	35.3	38.2	41.1	44.1
14	16.4	17.7	19.1	20.5	21.8	24.5	27.3	30.0	32.7	35.5	38.2	40.9
15	15.3	16.6	17.8	19.1	20.4	22.9	25.5	28.0	30.6	33.1	35.7	38.2
16	14.3	15.5	16.7	17.9	19.1	21.5	23.9	26.3	28.7	31.0	33.4	35.8
17	13.5	14.6	15.7	16.9	18.0	20.2	22.5	24.7	27.0	29.2	31.5	33.7
18	12.7	13.8	14.9	15.9	17.0	19.1	21.2	23.3	25.5	27.6	29.7	31.8
Feet per Minute	60	65	70	75	80	90	100	110	120	130	140	150

## Special Cutters



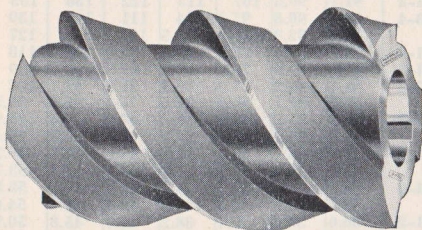
### STAGGERED TOOTH SIDE MILLING CUTTERS

This type of cutter with undercut teeth has been developed for milling deep slots in steel. The teeth are cut at alternate right- and left-hand spiral angles and are capable of removing a large amount of metal without destructive vibration and chatter leaving the work with a good finish.

### HELICAL MILLING CUTTERS

Due to the increased spiral angle this type of cutter is particularly advantageous for milling wide surfaces, for taking heavy cuts on thin material and for milling work that cannot be clamped at both ends. The Helical cutter shown below, with taper shank and guiding pilot, is used in railroad shops for milling the open ends of connecting rods and will speed up production and secure smooth, true surfaces without springing the work.

Write to our Cutter Department, stating your requirements.

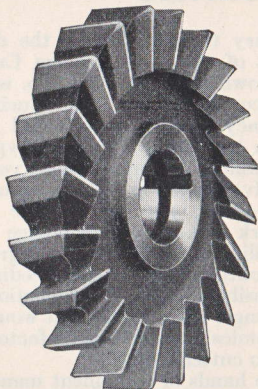




## Special Cutters

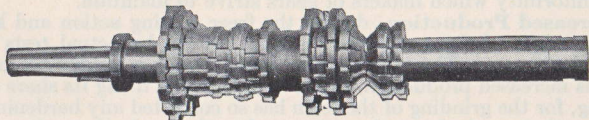
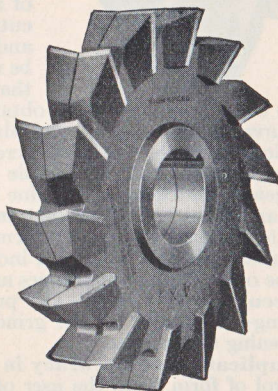
### SINGLE SIDE SIDE MILLING CUTTERS

For all side cuts where one side only is needed, and also for use in pairs for cutting slots of definite width where bottom finishing is not required. Note spiral on the top and undercut on the side which give teeth an improved cutting action.



### INTERLOCKING SIDE MILLING CUTTERS

Interlocking cutters have the advantages of single side side mills i. e., efficient cutting and adjustment for maintaining width of slot; and have the added advantage of finishing the bottom of the slot. Considerable adjustment is allowed for as the cutter is resharpened and for cutting slots where the width varies slightly.

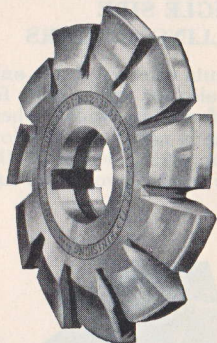


### Group of Special and Formed Cutters for Special Milling Operation

In addition to manufacturing a great variety of shapes and forms of special purpose cutters for work on metal we also make cutters for use on other materials including leather, rubber, bamboo, paper and cloth. Our great fund of knowledge in designing special cutters places us in a good position to take care of our customers' requirements.



## Ground-Form Cutters



THE primary thought behind the development of the Ground-Form Cutter by the Brown & Sharpe Mfg. Co. was to obtain a cutter capable of producing greater accuracy of work than could be obtained with one of the unground type. From the beginning we foresaw some very promising advantages in the Ground-Form Cutter—first, a cutter capable of producing work of a very high degree of accuracy—ability to duplicate this degree of accuracy continuously with succeeding cutters—a possible increase in production, and a much longer lived cutter that would be more economical, considering all factors that enter into cutter cost.

In every way the results obtained in the hands of prominent manufacturers in this country and abroad, have exceeded our expectations, particularly in the matter of increased production obtained and ultimate cutter economy secured. While we can furnish ground-form cutters for gears, sprockets, and spline shafts, and for other uses where the size and form are within certain limitations, we call particular attention to the merits of ground-form gear cutters, which can be furnished for pitches, from 1 3-4 to 12, inclusive.

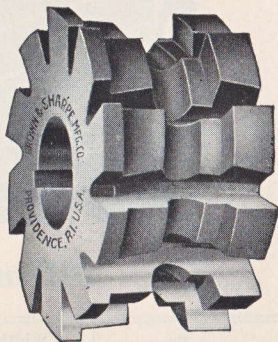
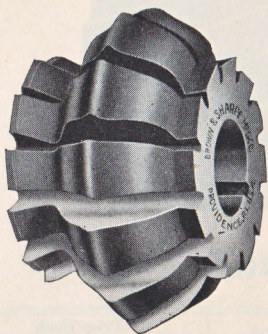
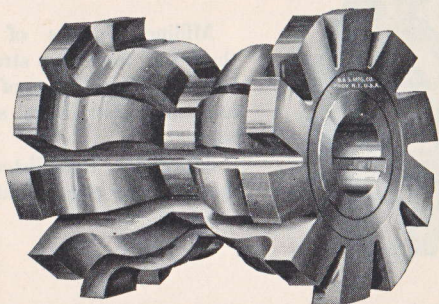
The outstanding advantages are as follows:

**Accuracy of Form**—the primary requirement in precision gear cutting—is assured by the grinding of the tooth form—correcting all hardening distortions.

**Duplication of Accuracy** in different cutters through this positive control of form gives the user of cutters further ability to duplicate a high degree of accuracy in the finished gears—a continued accuracy and uniformity which makers of gears strive to maintain.

**Increased Production**, due to the freer cutting action and keener cutting edges of these cutters, has been proven by actual tests to be surprisingly great. The freer cutting action, which is largely responsible for this increased production, is due to each tooth doing its share of the cutting, for the grinding of the form has so corrected any hardening distortions that no single tooth or group of teeth can do the major part of the work—each must do its share. Consequently the finish is correspondingly improved and cutter wear greatly reduced. As to cost, these Ground-Form Cutters necessarily list somewhat higher than those with the unground form, but their ability to produce more and better gears per sharpening of the cutter will effect a pronounced saving in ultimate cutter cost—they mean high cutter economy from all angles, both as to quality and quantity of the gears produced.

## Formed Cutters

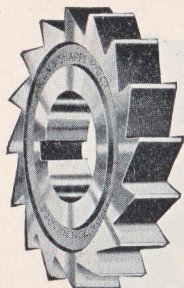


**F**ORMED cutters can be made in a great variety of outlines and can be sharpened by grinding without changing their form.

They are economical in the production of duplicate and interchangeable parts.

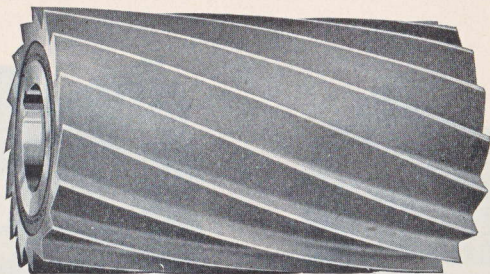
In ordering send sketch or sample of piece to be milled, with size of hole required in cutter.

## Milling Cutters



Milling Cutters of less than 3-4" face have straight teeth. Milling Cutters of 3-4" face and over have spiral teeth.

Other sizes than listed on the following pages made to order.



## Milling Cutters

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price Each	
				Carbon Steel	High-Speed Steel
M-10	2 1-4	1-2	7-8	\$2.25	\$4.15
M-11	2 1-4	1	7-8	3.20	6.00
M-12	2 1-4	1 3-4	7-8	4.20	8.40

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*List continued on next page.*



# Milling Cutters

(Continued)

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price Each	
				Carbon Steel	High-Speed Steel
M-14	2 1-2	3-16	1	\$1.65	\$3.25
M-15	2 1-2	1-4	1	1.80	3.50
M-16	2 1-2	5-16	1	1.90	3.75
M-17	2 1-2	3-8	1	2.10	4.00
M-18	2 1-2	7-16	1	2.20	4.25
M-19	2 1-2	1-2	1	2.30	4.50
M-20	2 1-2	9-16	1	2.50	4.80
M-21	2 1-2	5-8	1	2.50	4.80
M-22	2 1-2	11-16	1	2.80	5.40
M-23	2 1-2	3-4	1	2.80	5.40
M-24	2 1-2	13-16	1	3.10	6.00
M-25	2 1-2	7-8	1	3.10	6.00
M-26	2 1-2	1	1	3.30	6.50
M-28	2 1-2	1 1-4	1	3.70	7.50
M-29	2 1-2	1 1-2	1	4.00	8.25
M-30	2 1-2	1 3-4	1	4.35	9.15
M-31	2 1-2	2	1	4.75	10.10
M-33	2 1-2	2 1-2	1	5.25	11.60
M-35	2 1-2	3	1	5.70	13.00
M-37	2 1-2	4	1	7.00	16.35
M-38	2 3-4	3-16	1	1.75	3.40
M-39	2 3-4	1-4	1	2.00	3.75
M-40	2 3-4	5-16	1	2.10	3.90
M-41	2 3-4	3-8	1	2.30	4.30
M-42	2 3-4	7-16	1	2.35	4.50
M-43	2 3-4	1-2	1	2.40	4.70
M-44	2 3-4	9-16	1	2.70	5.35
M-45	2 3-4	5-8	1	2.70	5.35
M-45B	2 3-4	3-4	1	3.20	6.25
M-45C	2 3-4	7-8	1	3.65	7.10
M-46	2 3-4	1	1	4.00	7.85
M-48	2 3-4	1 1-4	1	4.35	8.80
M-49	2 3-4	1 1-2	1	4.80	9.90
M-51	2 3-4	2	1	5.35	11.60
M-52	2 3-4	2 1-2	1	5.85	13.25
M-53	2 3-4	3	1	6.40	15.25
M-55	2 3-4	4	1 1-4	7.65	18.60

List of Keyways, page 281.

List continued on next page.

## Milling Cutters

(Continued)

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
M-61	3	3-16	1	\$1.75	\$3.60
M-62	3	1-4	1	2.10	4.00
M-63	3	5-16	1	2.35	4.50
M-63A	3	3-8	1	2.70	5.10
M-64	3	3-8	1 1-4	2.70	5.10
M-65	3	7-16	1 1-4	2.85	5.40
M-66	3	1-2	1 1-4	3.10	5.90
M-67	3	9-16	1 1-4	3.50	6.75
M-68	3	5-8	1 1-4	3.50	6.75
M-70	3	3-4	1 1-4	3.85	7.50
M-71	3	7-8	1 1-4	4.20	8.25
M-72	3	1	1 1-4	4.60	9.10
M-73	3	1 1-4	1 1-4	5.10	10.35
M-74	3	1 1-2	1 1-4	5.50	11.50
M-75	3	1 3-4	1 1-4	5.70	12.30
M-76	3	2	1 1-4	6.00	13.30
M-77	3	2 1-2	1 1-4	6.60	15.25
M-78	3	3	1 1-4	7.00	17.00
M-79	3	3 1-2	1 1-4	7.50	18.80
M-80	3	4	1 1-4	8.15	20.75
M-81	3	5	1 1-4	9.90	25.50
M-82	3	6	1 1-4	13.70	33.00
M-83	3 1-2	3-16	1	1.85	4.00
M-84	3 1-2	1-4	1	2.20	4.50
M-85	3 1-2	5-16	1	2.65	5.35
M-86	3 1-2	3-8	1	3.10	6.10
M-87	3 1-2	7-16	1	3.50	6.90
M-88	3 1-2	1-2	1 1-4	4.00	7.70
M-90	3 1-2	5-8	1 1-4	4.40	8.65
M-92	3 1-2	3-4	1 1-4	4.90	9.70
M-93	3 1-2	7-8	1 1-4	5.60	11.10
M-94	3 1-2	1	1 1-4	6.10	12.15
M-96	3 1-2	1 1-2	1 1-4	7.10	15.10
M-98	3 1-2	2	1 1-4	8.15	18.10
M-99	3 1-2	2 1-2	1 1-4	8.75	20.35
M-100	3 1-2	3	1 1-4	9.40	22.75
M-101	3 1-2	3 1-2	1 1-4	10.35	25.65
M-102	3 1-2	4	1 1-4	11.60	28.85
M-102A	3 1-2	4	1 1-2	11.60	28.85

List of Keyways, page 281.

*List continued on next page.*

## Milling Cutters (Continued)

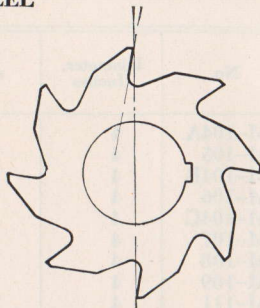
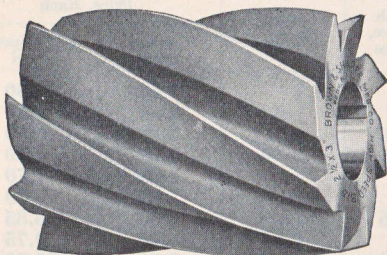
No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
M-104A	4	1-4	1	\$2.60	\$5.50
M-105	4	1-4	1 1-4	2.60	5.50
M-104B	4	5-16	1	3.20	6.50
M-106	4	5-16	1 1-4	3.20	6.50
M-104C	4	3-8	1	3.85	7.70
M-107	4	3-8	1 1-4	3.85	7.70
M-108	4	7-16	1 1-4	4.50	8.85
M-109	4	1-2	1 1-4	5.00	9.75
M-111	4	9-16	1 1-4	5.50	10.90
M-112	4	5-8	1 1-4	5.50	10.90
M-114	4	3-4	1 1-4	6.00	12.10
M-116	4	7-8	1 1-4	6.50	13.35
M-117	4	1	1 1-4	7.15	14.70
M-118	4	1	1 1-2	7.15	14.70
M-119	4	1 1-4	1 1-4	7.90	16.70
M-120	4	1 1-4	1 1-2	7.90	16.70
M-121	4	1 1-2	1 1-4	8.40	18.40
M-122	4	1 1-2	1 1-2	8.40	18.40
M-123	4	1 3-4	1 1-4	9.00	20.25
M-124	4	1 3-4	1 1-2	9.00	20.25
M-125	4	2	1 1-4	9.50	21.90
M-126	4	2	1 1-2	9.50	21.90
M-128	4	3	1 1-4	11.50	28.50
M-128A	4	3	1 1-2	11.50	28.50
M-130	4	4	1 1-4	14.00	36.75
M-131	4	4	1 1-2	14.00	36.75
M-133	4	5	1 1-2	17.10	45.20
M-136	4	6	1 1-2	19.65	54.10
M-142	4 1-2	1-2	2	5.10	10.65
M-146	4 1-2	5-8	2	5.60	11.90
M-150	4 1-2	3-4	2	6.10	13.25
M-152	4 1-2	7-8	2	6.70	14.65
M-154	4 1-2	1	2	7.50	16.40
M-156	4 1-2	1 1-4	2	8.60	19.15
M-158	4 1-2	1 1-2	2	9.50	21.65
M-160	4 1-2	1 3-4	2	10.50	24.25
M-162	4 1-2	2	2	10.80	25.90
M-163	4 1-2	6	2	24.70	68.00

List of Keyways, page 281.



## Coarse-Tooth Plain Milling Cutters

### HIGH-SPEED STEEL



See page 240 for explanation of advantages of Coarse-Tooth Cutters.

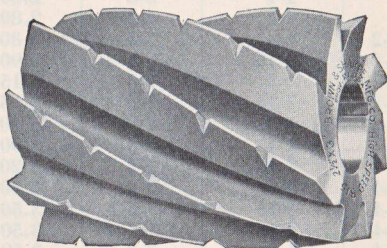
No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price, Each
*M-250	2 1-2	1	1	\$6.50
*M-251	2 1-2	1 1-4	1	7.50
*M-252	2 1-2	1 1-2	1	8.25
*M-253	2 1-2	1 3-4	1	9.15
M-254	2 1-2	2	1	10.10
M-255	2 1-2	2 1-2	1	11.60
M-256	2 1-2	3	1	13.00
M-257	2 1-2	4	1	16.35
*M-258	3	1	1 1-4	9.10
*M-259	3	1 1-4	1 1-4	10.35
*M-260	3	1 1-2	1 1-4	11.50
M-261	3	2	1 1-4	13.30
M-262	3	2 1-2	1 1-4	15.25
M-263	3	3	1 1-4	17.00
M-264	3	4	1 1-4	20.75
M-265	3	5	1 1-4	25.50
M-266	3	6	1 1-4	33.00
*M-267	3 1-2	1	1 1-2	12.15
*M-268	3 1-2	1 1-2	1 1-2	15.10
*M-269	3 1-2	2	1 1-2	18.10
M-270	3 1-2	2 1-2	1 1-2	20.35
M-271	3 1-2	3	1 1-2	22.75
M-272	3 1-2	4	1 1-2	28.85
M-273	3 1-2	5	1 1-2	35.00
M-274	3 1-2	6	1 1-2	41.75

\*Made to order only. List of Keyways, page 281.  
List continued on next page.

**Coarse-Tooth Plain Milling Cutters** *(Continued)*

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price, Each
*M-275	4	1	1 1-2	<b>\$14.70</b>
*M-276	4	1 1-4	1 1-2	<b>16.70</b>
*M-277	4	1 1-2	1 1-2	<b>18.40</b>
*M-278	4	2	1 1-2	<b>21.90</b>
M-279	4	3	1 1-2	<b>28.50</b>
M-280	4	4	1 1-2	<b>36.75</b>
M-281	4	5	1 1-2	<b>45.20</b>
M-282	4	6	1 1-2	<b>54.10</b>
*M-283	4 1-2	1	2	<b>16.40</b>
*M-284	4 1-2	1 1-4	2	<b>19.15</b>
*M-285	4 1-2	1 1-2	2	<b>21.65</b>
*M-286	4 1-2	2	2	<b>25.90</b>
M-287	4 1-2	3	2	<b>36.15</b>
M-288	4 1-2	4	2	<b>45.65</b>
M-289	4 1-2	5	2	<b>57.30</b>
M-290	4 1-2	6	2	<b>68.00</b>

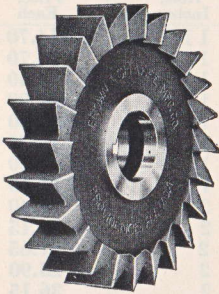
\*Made to order only.

**Coarse-Tooth Plain Milling Cutters**  
**WITH NICKED TEETH****High-Speed Steel**

No.	Diameter, Inches	Width of Face, Inches	Hole Inches	Price, Each
M-301	2 1-2	3	1	<b>\$14.30</b>
M-310	3	4	1 1-4	<b>22.85</b>
M-318	3 1-2	4	1 1-2	<b>31.75</b>
M-321	3 1-2	6	1 1-2	<b>46.00</b>
M-343	4 1-2	4	2	<b>50.20</b>
M-345	4 1-2	6	2	<b>74.80</b>

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Side Milling Cutters



These cutters are often used in pairs for sizing nuts, bolt heads, etc., and are then called "Straddle Mills." They have cutting edges on both sides of the teeth as well as on the periphery. Other sizes made to order.

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
S-10	2	3-16	1-2	\$2.35	\$3.60
S-11	2	1-4	1-2	2.60	4.10
S-12	2	3-8	1-2	2.80	4.50
S-13	2	3-16	5-8	2.35	3.60
S-14	2	1-4	5-8	2.60	4.10
S-15	2	3-8	5-8	2.80	4.50
S-16	2 1-2	1-4	7-8	2.80	4.65
S-17	2 1-2	5-16	7-8	2.90	4.90
S-18	2 1-2	3-8	7-8	3.15	5.30
S-19	2 1-2	7-16	7-8	3.25	5.50
S-20	2 1-2	1-2	7-8	3.40	5.80
S-21	2 3-4	1-4	7-8	2.90	5.00
S-22	2 3-4	5-16	7-8	3.20	5.50
S-23	2 3-4	3-8	7-8	3.40	5.80
S-24	2 3-4	7-16	7-8	3.50	6.10
S-24A	2 3-4	7-16	1	3.50	6.10
S-25	2 3-4	1-2	7-8	3.60	6.40
S-25A	2 3-4	1-2	1	3.60	6.40
S-26	3	1-4	1	3.15	5.40
S-27	3	5-16	1	3.60	6.25
S-28	3	3-8	1	3.85	6.65
S-29	3	7-16	1	4.10	7.15
S-30	3	1-2	1	4.30	7.65
S-30A	3	1-2	1 1-4	4.30	7.65

List continued on next page.

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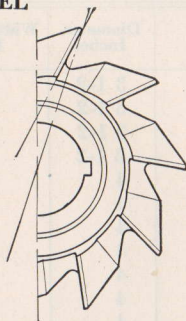
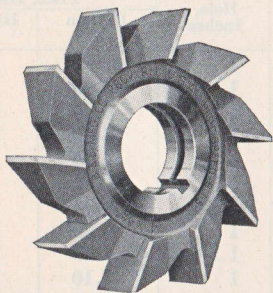
## Side Milling Cutters (Continued)

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
S-31	3 1-2	7-16	1	\$4.80	\$8.65
S-32	3 1-2	1-2	1	5.35	9.60
S-33	3 1-2	9-16	1	5.80	10.65
S-34	3 1-2	5-8	1	5.80	10.65
S-34A	4	1-4	1	3.70	7.00
S-34B	4	3-8	1	5.20	9.50
S-34C	4	3-8	1 1-4	5.20	9.50
S-35	4	1-2	1	6.50	11.90
S-35A	4	1-2	1 1-4	6.50	11.90
S-36	4	5-8	1	7.10	13.15
S-38	4	5-8	1 1-4	7.10	13.15
S-39	4	3-4	1	7.65	14.40
S-39A	4	3-4	1 1-4	7.65	14.40
S-40	4	7-8	1	8.25	17.30
S-40A	4	7-8	1 1-4	8.25	17.30
S-40B	5	1-2	1	6.70	13.60
S-40C	5	1-2	1 1-4	6.70	13.60
S-41	5	3-4	1	8.10	17.10
S-42	5	3-4	1 1-4	8.10	17.10
S-42A	5	5-8	1	7.30	15.20
S-42B	5	5-8	1 1-4	7.30	15.20
S-43	5	7-8	1	8.75	18.75
S-43A	5	7-8	1 1-4	8.75	18.75
S-44	5	1	1	9.90	20.20
S-44A	5	1	1 1-4	9.90	20.20
S-44B	6	1-2	1	8.60	18.65
S-44C	6	1-2	1 1-4	8.60	18.65
S-44D	6	5-8	1 1-4	9.10	20.40
S-45	6	3-4	1	9.65	22.25
S-45A	6	3-4	1 1-4	9.65	22.25
S-46	6	7-8	1 1-4	10.25	24.20
S-47	6	1	1 1-2	11.00	26.40
S-47A	6	1	1	11.00	26.40
S-47B	6	1	1 1-4	11.00	26.40
S-47C	7	3-4	1 1-4	17.50	36.25
S-48	7	1	1 1-4	20.40	43.15
S-50	8	1	1 1-4	24.75	55.20

List of Keyways, page 281.

## Coarse-Tooth Side Milling Cutters

### HIGH-SPEED STEEL



See page 240 for explanation of advantages of Coarse-Tooth Cutters.

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price, Each
S-300	2 1-2	1-4	1	\$4.65
S-301	2 1-2	5-16	1	4.90
S-302	2 1-2	3-8	1	5.30
S-304	3	1-4	1 1-4	5.40
S-305	3	5-16	1 1-4	6.25
S-306	3	3-8	1 1-4	6.65
S-307	3	7-16	1 1-4	7.15
S-308	3	1-2	1 1-4	7.65
S-312	3 1-2	7-16	1 1-4	8.65
S-313	3 1-2	1-2	1 1-4	9.60
S-314	3 1-2	5-8	1 1-4	10.65
S-317A	4	1-2	1 1-4	11.90
S-317	4	1-2	1 1-2	11.90
S-318A	4	5-8	1 1-4	13.15
S-318	4	5-8	1 1-2	13.15
S-319A	4	3-4	1 1-4	14.40
S-319	4	3-4	1 1-2	14.40
S-320A	4	7-8	1 1-4	17.30
S-320	4	7-8	1 1-2	17.30
S-323A	5	3-4	1 1-4	17.10
S-323	5	3-4	1 1-2	17.10
S-324A	5	7-8	1 1-4	18.75
S-324	5	7-8	1 1-2	18.75
S-325	5	1	1 1-2	20.20
S-326	6	3-4	1 1-2	22.25
S-328	6	1	1 1-2	26.40
S-329	8	1	1 1-2	55.20

Other sizes made to order.

List of Keyways, page 281.

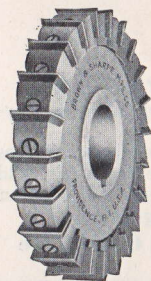
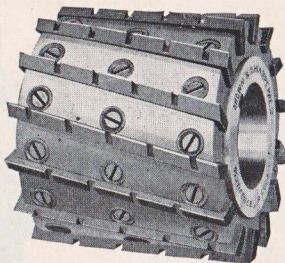
## Milling Cutters

### WITH INSERTED TEETH

We recommend that Milling Cutters of more than 8" in diameter be made with inserted teeth. The teeth of the cutters are inserted in the periphery of the machinery steel body, and are regularly furnished of high-speed steel, but carbon steel teeth can be furnished, if desired.

Prices upon application.

The bushings, screws and teeth are interchangeable, thus allowing the teeth to be easily adjusted or removed.



## Side Milling Cutters

### WITH INSERTED TEETH

When Side Milling Cutters of more than 8" in diameter are required we recommend that they be made with inserted teeth. The cutters have machinery steel bodies and are regularly furnished with teeth of high speed steel, at prices listed below. Prices of cutters with carbon steel teeth on application. The bushings, screws and teeth are interchangeable, thus allowing the teeth to be easily adjusted or removed.

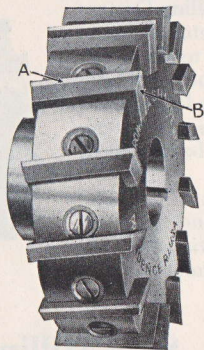
No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	With High-Speed Steel Teeth, Price, Each
S-100	6	2	1 1-4	\$55.50
S-101	7	2	1 1-4	61.80
S-101A	7	2	1 3-4	61.80
S-102	8	2	1 1-2	69.50
S-102A	8	2	2	69.50
S-103	9	2	1 1-2	77.80
S-104	10	2	1 1-2	86.65

Other sizes made to order. List of Keyways, page 281.



## Face Milling Cutters

### WITH INSERTED TEETH



**Left-Hand Cutter**

These Cutters are especially adapted to all classes of face milling.

The body is of machinery steel provided with a taper hole and key-way and is held firmly in place on the arbor by a screw.

Cutters are regularly furnished with teeth of high-speed steel. Prices of Cutters with carbon steel teeth on application. The teeth are held in place by taper bushings and screws and can be easily adjusted or removed. The bushings, screws and teeth are interchangeable.

**In ordering, state whether Right- or Left-Hand Cutters are wanted**

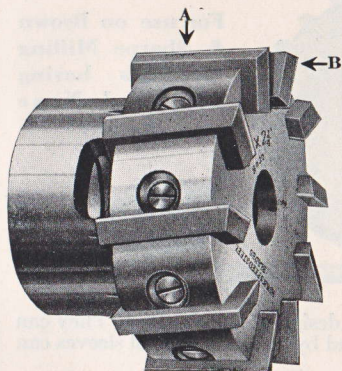
No. of Cutter	Size, Inches	Face A, Inches	Face B, Inches	No. of Taper Hole	No. of Arbor on which Cutter can be used	Price, Each With High-Speed Teeth
1	5 1-2	2 1-4	1 1-16	10	79 or 80	\$64.10
2	5 1-2	2 1-4	1 1-16	12	81, 82, 84, 85 or 87	65.10
3	6 1-2	2 1-4	1 1-16	10	79 or 80	71.10
4	6 1-2	2 1-4	1 1-16	12	81, 82, 83, 84, 85 or 87	72.10
6	7 1-2	2 1-4	1 1-16	12	81, 82, 83, 84, 85 or 87	81.25
7	8 1-2	2 1-4	1 3-16	12	81, 82, 83, 84, 85 or 87	91.15
8	9 1-2	2 1-4	1 3-16	12	81, 82, 83, 84, 85 or 87	101.75

Other sizes made to order.

**In ordering teeth, state whether for Right- or Left-Hand Cutters.**  
List of Arbors, page 337.

## Face Milling Cutters

WITH INSERTED TEETH AND THREADED HOLES



Left-Hand Cutter

For use on Brown & Sharpe  
Milling Machines having  
Threaded Nose Spindle

These cutters can be used directly upon the spindle of Threaded-Nose Milling Machines. The body is of machinery steel and is regularly furnished with teeth of high-speed steel. Prices of carbon steel teeth on application. The teeth are held in place by taper bushings and screws, and can be easily adjusted or removed. The bushings, screws and teeth are interchangeable.

In ordering teeth, state whether for Right- or Left-Hand Cutters.

No. of Cutter	Cutter			Hole		Price Each With High-Speed Steel Teeth
	Diameter, Inches	Face A, Inches	Face B, Inches	Diameter, Inches	Thread	
10	5 1-2	2 1-4	1 1-16	2 1-2	4, L. H.	\$67.10
12	6 1-2	2 1-4	1 1-16	2 1-2	4, L. H.	74.60
16	7 1-2	2 1-4	1 1-16	2 1-2	4, L. H.	83.75
15	6 1-2	2 1-4	1 1-16	3 1-4	3 1-2, L. H.	74.60
18	7 1-2	2 1-4	1 1-16	3 1-4	3 1-2, L. H.	83.75
21	8 1-2	2 1-4	1 3-16	3 1-4	3 1-2, L. H.	93.65
24	9 1-2	2 1-4	1 3-16	3 1-4	3 1-2, L. H.	104.25
19	7 1-2	2 1-4	1 1-16	4	3, L. H.	83.75
22	8 1-2	2 1-4	1 3-16	4	3, L. H.	93.65
25	9 1-2	2 1-4	1 3-16	4	3, L. H.	104.25
22A	8 1-2	2 1-4	1 3-16	4 1-2	2 3-4, L. H.	93.65
26	9 1-2	2 1-4	1 3-16	4 1-2	2 3-4, L. H.	104.25

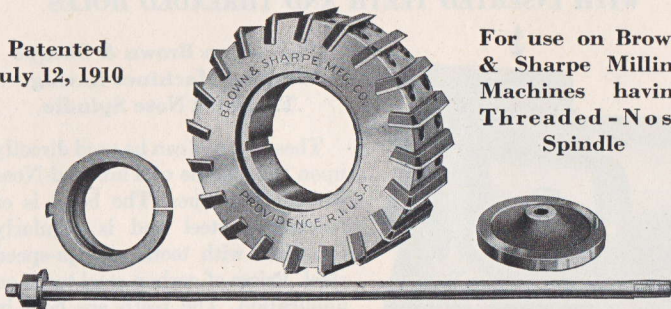
Other sizes made to order.

# Face Milling Cutters

## WITH INSERTED TEETH

**Patented**  
**July 12, 1910**

**For use on Brown  
& Sharpe Milling  
Machines having  
Threaded - Nose  
Spindle**



Important features are found in the design of these cutters. They can be released quickly from the spindle and by means of special sleeves can be used on spindles of different sizes.

A taper hole in the cutter fits a split steel sleeve that screws on to the spindle. The cutter is keyed to this sleeve and drawn on to the taper by a drawing-in bolt. This furnishes a positive cutter drive at all times and the split sleeve assures quick release with no "freezing."

The body of the cutter is of machinery steel, while the teeth are of high-speed steel. For prices of Sleeves, Clamping Plates, and Drawing-in Bolts, see next page.

**In ordering teeth, state whether for Right- or Left-Hand Cutters.**

No. of Cutter	Diameter of Cutter, Inches	Face A, Inches	Face B, Inches	Sm. Diam. of Taper Hole, Inches	Used with Sleeve No.	Price, Each With High-Speed Steel Teeth
50	7	3	15-16	3	1	\$85.50
51	8	3	15-16	3	1	96.00
52	8	3 1-4	15-16	3 3-4	2 and 5	103.20
53	9	3 1-4	15-16	3 3-4	2 and 5	116.00
54	9	3 1-2	15-16	4 1-2	6 and 8	118.10
55	9	3 3-4	15-16	5	7, 9 and 10	120.00
56	10	3 1-4	15-16	3 3-4	2 and 5	129.85
57	10	3 1-2	15-16	4 1-2	6 and 8	132.00
58	10	3 3-4	15-16	5	7, 9 and 10	133.80
59	12	3 1-2	15-16	4 1-2	6 and 8	155.70
60	12	3 3-4	15-16	5	7, 9 and 10	158.30
61	15	3 3-4	15-16	5	7, 9 and 10	199.40

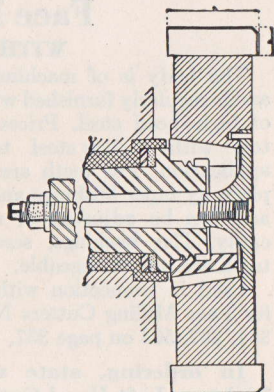
Other sizes made to order.



# Sleeves, Clamping Plates and Drawing-In Bolts and Nuts

For use with Cutters Shown  
on Opposite Page

For use on Brown & Sharpe  
Milling Machines having  
Threaded-Nose Spindle.



## SLEEVES

No. of Sleeve	Outside Diameter of Small End, Inches	Length, Inches	Taper per Foot in Diameter, Inches	Bore		Price
				Diameter, Inches	Threads per Inch	
1	3	2	3 1-2	2 1-2	4, L. H., U. S. S.	\$6.00
2	3 3-4	2 1-4	3 1-2	2 1-2	4, L. H., U. S. S.	6.50
5	3 3-4	2 1-4	3 1-2	3 1-4	3 1-2, L. H., U. S. S.	7.00
6	4 1-2	2 1-2	3 1-2	3 1-4	3 1-2, L. H., U. S. S.	7.50
7	5	2 3-4	3 1-2	3 1-4	3 1-2, L. H., U. S. S.	8.00
8	4 1-2	2 1-2	3 1-2	4	3, L. H., U. S. S.	8.00
9	5	2 3-4	3 1-2	4	3, L. H., U. S. S.	8.50
10	5	2 3-4	3 1-2	4 1-2	2 3-4, L. H., U. S. S.	9.00

## CLAMPING PLATES

No. of Plate	Used with Cutter	Diameter of Tapped Hole, Inches	Price
1	50 and 51	5-8	\$1.00
2	52, 53 and 56	5-8	1.00
3	52, 53 and 56	11-16	1.00
4	54, 57 and 59	11-16	1.00
5	55, 58, 60 and 61	11-16	1.00

## DRAWING-IN BOLTS AND NUTS

Price, \$1.50

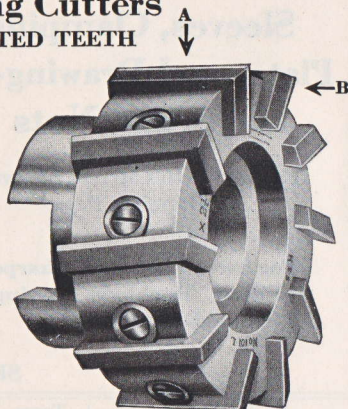
The drawing-in bolts with nuts for use with these cutters are furnished on short notice. When ordering, the diameter of the spindle hole and the length of the spindle over all must be given.

## Face Milling Cutters WITH INSERTED TEETH

The body is of machinery steel and is regularly furnished with teeth of high-speed steel. Prices of cutters with carbon steel teeth on application. The teeth are held in place by taper bushings and screws and can be adjusted or removed easily. The bushings, screws and teeth are interchangeable.

Used in connection with Arbors for Face Milling Cutters Nos. 580, 581, 582, 583 on page 337.

In ordering, state whether Right- or Left-Hand Cutters are wanted.

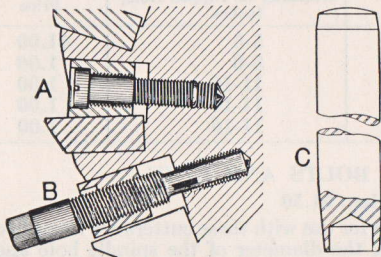


Left-Hand Cutter

No. of Cutter	Diam. of Cutter, Inches	Face A, Inches	Face B, Inches	Machines where used	Price, Each with High-Speed Steel Teeth
101	5 1-2	2 1-4	1 1-16	On all machines with Taper-Nose Spindle	\$65.60
103	6 1-2	2 1-4	1 1-16	Used in conjunction with Arbors for Face Milling Cutters on page 288	72.60
106	7 1-2	2 1-4	1 1-16		81.75

See pages 234 and 235 for explanation of Taper-Nose Spindle.

## Removing and Inserting Teeth



To remove a tooth, take out the screw A and insert extractor B as shown. By turning the extractor with a wrench the bushing is forced out. The tooth can then be removed.

To insert a tooth, place blade in position, drive bushing securely into place, using set C. Then insert screw A and tighten firmly. An extractor and set are furnished with each cutter.



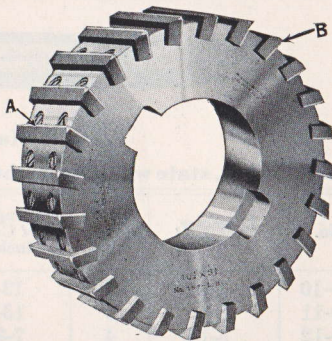
## Face Milling Cutters WITH INSERTED TEETH

For use on Brown & Sharpe  
Milling Machines having  
Taper-Nose Spindle.

These cutters are fitted directly on nose of spindle without the use of an arbor. The body of the cutter is of machinery steel; the teeth are of high-speed steel. Price of carbon steel teeth on application.

The teeth are held in place by taper bushings and screws, and can be easily adjusted or removed. The bushings, screws, and teeth are interchangeable.

In ordering, state whether  
Right- or Left-Hand Cutters are wanted.



Left-Hand Cutter

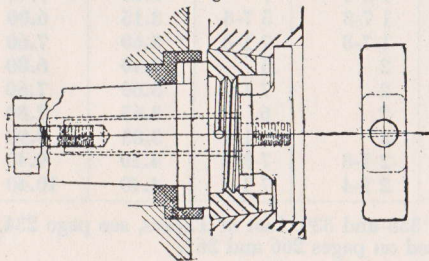
No. of Cutter	Diam. of Cutter, Inches	Face A, Inches	Face B, Inches	Machines where used	With High-Speed Steel Teeth, Price, Each
150	6	2 1-4	7-8	{ *1-*1A-2-2A Univ. M. M.; 1 Hy. Vert. Sp. M. Att. *1-*1B-2-2B Pl. M. M.; 21 Auto. M. M.	\$80.00
151	7	3	15-16		92.65
152	8	3	15-16		96.00
155	8 1-2	3 1-4	15-16	{ 3-3A-3A Hy.-4A-4A Hy. Univ. M. M.; 2-3-5 Vert. Sp. M. M.; 2B Hy.-3-3B-3B Hy.-4B-4B Hy.- 5B Hy.-13B Pl. M. M.; 33 Auto. M. M. 2 Hy.-3-4-5-3 Hy.-4 Hy.-5 Hy. Vert. Sp. M. Att.	112.10
156	9 1-2	3 5-8	15-16		129.30
157	10 1-2	3 5-8	15-16		141.20
158	12	3 5-8	15-16		158.30
159	15	3 5-8	15-16		199.40

\*With or without back gears.

## Adapter Outfit

Permits cutters to be used on threaded-nose spindle. It consists of taper sleeve with threaded hole driver and drawing-in bolt.

When ordering give size and serial number of machine. Price on application.





## End Mills



### Left-Hand Mill

In ordering, state whether Right- or Left-Hand Mills are wanted

No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
E-10	1-4	4	13-16	2 7-16	\$1.35	\$2.10
E-11	1-4	5	13-16	3	1.80	2.80
E-12	5-16	4	7-8	2 1-2	1.35	2.10
E-13	5-16	5	7-8	3 1-16	1.80	2.90
E-14	3-8	4	7-8	2 1-2	1.35	2.10
E-15	3-8	5	7-8	3 1-16	1.80	2.90
E-16	7-16	4	15-16	2 9-16	1.35	2.10
E-17	7-16	5	15-16	3 1-8	1.80	2.90
E-18	1-2	5	1	3 3-16	1.80	2.90
E-19	1-2	7	1 1-8	5 1-8	2.70	4.60
E-20	9-16	5	1 1-16	3 1-4	1.80	2.90
E-21	9-16	7	1 1-4	5 1-4	2.70	4.60
E-22	5-8	5	1 1-4	3 7-16	1.90	3.10
E-23	5-8	7	1 1-2	5 1-2	2.70	4.60
E-24	11-16	7	1 1-2	5 1-2	2.70	4.60
E-26	3-4	7	1 5-8	5 5-8	2.70	4.70
E-27	3-4	9	1 5-8	6 7-8	3.60	7.40
E-30	7-8	7	1 3-4	5 3-4	2.90	5.30
E-31	7-8	9	1 3-4	7	3.60	7.40
E-34	1	7	1 7-8	5 7-8	3.15	6.00
E-35	1	9	1 7-8	7 1-8	3.60	7.60
E-38	1 1-8	7	2	6	3.40	6.80
E-39	1 1-8	9	2	7 1-4	3.60	7.60
E-42	1 1-4	7	2	6	3.65	7.80
E-43	1 1-4	9	2	7 1-4	3.85	8.90
E-45	1 3-8	9	2 1-8	7 3-8	4.10	9.40
E-47	1 1-2	9	2 1-4	7 1-2	4.40	10.40

List of Collets, see pages 338 and 339. List of Tapers, see page 234. Morse Taper End Mills listed on pages 266 and 267.

## Spiral End Mills



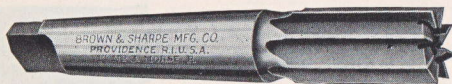
### Left-Hand Mill

In ordering, state whether Right- or Left-Hand Mills are wanted

No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
E-100	1-4	4	13-16	2 7-16	\$1.35	\$2.10
E-101	1-4	5	13-16	3	1.80	2.80
E-102	5-16	4	7-8	2 1-2	1.35	2.10
E-103	5-16	5	7-8	3 1-16	1.80	2.90
E-104	3-8	4	7-8	2 1-2	1.35	2.10
E-105	3-8	5	7-8	3 1-16	1.80	2.90
E-106	7-16	4	15-16	2 9-16	1.35	2.10
E-107	7-16	5	15-16	3 1-8	1.80	2.90
E-108	1-2	5	1	3 3-16	1.80	2.90
E-109	1-2	7	1 1-8	5 1-8	2.70	4.60
E-110	9-16	5	1 1-16	3 1-4	1.80	2.90
E-111	9-16	7	1 1-4	5 1-4	2.70	4.60
E-112	5-8	5	1 1-4	3 7-16	1.90	3.10
E-113	5-8	7	1 1-2	5 1-2	2.70	4.60
E-114	11-16	7	1 1-2	5 1-2	2.70	4.60
E-115	11-16	9	1 1-2	6 3-4	3.60	7.40
E-116	3-4	7	1 5-8	5 5-8	2.70	4.70
E-117	3-4	9	1 5-8	6 7-8	3.60	7.40
E-120	7-8	7	1 3-4	5 3-4	2.90	5.30
E-121	7-8	9	1 3-4	7	3.60	7.40
E-124	1	7	1 7-8	5 7-8	3.15	6.00
E-125	1	9	1 7-8	7 1-8	3.60	7.60
E-128	1 1-8	7	2	6	3.40	6.80
E-129	1 1-8	9	2	7 1-4	3.60	7.60
E-132	1 1-4	7	2	6	3.65	7.80
E-133	1 1-4	9	2	7 1-4	3.85	8.90
E-135	1 3-8	9	2 1-8	7 3-8	4.10	9.40
E-137	1 1-2	9	2 1-4	7 1-2	4.40	10.40
E-138	1 5-8	9	2 3-8	7 5-8	4.70	11.90
E-139	1 3-4	9	2 1-2	7 3-4	5.00	13.15

List of Collets, see pages 338 and 339. List of Tapers, see page 234.  
Morse Taper Spiral End Mills listed on pages 266 and 267.

## End Mills—Morse Taper



End Mills with Morse Taper are furnished regularly in right-hand only. Left-hand cutters can be furnished. Prices on Application.

No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
E-300	1-4	1	13-16	3 5-8	\$1.90	\$2.90
E-301	5-16	1	7-8	3 11-16	1.90	2.90
E-302	3-8	1	7-8	3 11-16	1.90	2.90
E-303	7-16	1	15-16	3 3-4	1.90	2.90
E-304	7-16	2	1	4 1-2	2.50	4.15
E-305	1-2	1	1	3 13-16	1.90	3.00
E-306	1-2	2	1 1-8	4 5-8	2.70	4.60
E-307	9-16	1	1 1-16	3 7-8	2.00	3.15
E-308	9-16	2	1 1-4	4 3-4	2.70	4.60
E-309	5-8	2	1 1-2	5	2.70	4.60
E-310	11-16	2	1 1-2	5	2.70	4.60
E-311	3-4	2	1 5-8	5 1-8	2.70	4.60
E-312	3-4	3	1 5-8	5 15-16	3.15	6.00
E-315	7-8	2	1 3-4	5 1-4	2.90	5.30
E-316	7-8	3	1 3-4	6 1-16	3.25	6.20
E-319	1	2	1 7-8	5 3-8	3.10	5.75
E-320	1	3	1 7-8	6 3-16	3.25	6.20
E-323	1 1-8	3	2	6 5-16	3.50	7.10
E-325	1 1-4	3	2	6 5-16	3.75	8.25

List of Collets, pages 338 and 339.

List of Tapers, page 234.



## Spiral End Mills—Morse Taper



Spiral End Mills with Morse Tapers are furnished regularly in right-hand only. Left-hand cutters can be furnished. Prices on Application.

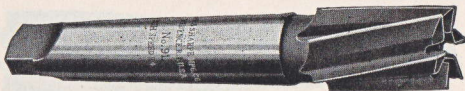
No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
E-395	1-4	1	13-16	3 5-8	\$1.90	\$2.90
E-396	5-16	1	7-8	3 11-16	1.90	2.90
E-397	3-8	1	7-8	3 11-16	1.90	2.90
E-398	7-16	1	15-16	3 3-4	1.90	2.90
E-399	7-16	2	1	4 1-2	2.50	4.15
E-400	1-2	1	1	3 13-16	1.90	3.00
E-401	1-2	2	1 1-8	4 5-8	2.70	4.60
E-402	9-16	1	1 1-16	3 7-8	2.00	3.15
E-403	9-16	2	1 1-4	4 3-4	2.70	4.60
E-404	5-8	2	1 1-2	5	2.70	4.60
E-405	11-16	2	1 1-2	5	2.70	4.60
E-406	3-4	2	1 5-8	5 1-8	2.70	4.60
E-407	3-4	3	1 5-8	5 15-16	3.15	6.00
E-410	7-8	2	1 3-4	5 1-4	2.90	5.30
E-411	7-8	3	1 3-4	6 1-16	3.25	6.20
E-414	1	2	1 7-8	5 3-8	3.10	5.75
E-415	1	3	1 7-8	6 3-16	3.25	6.20
E-418	1 1-8	3	2	6 5-16	3.50	7.10
E-420	1 1-4	3	2	6 5-16	3.75	8.25
E-421	1 1-4	4	2	7 3-8	3.85	8.90
E-424	1 3-8	3	2 1-8	6 7-16	4.00	8.75
E-425	1 3-8	4	2 1-8	7 1-2	4.10	9.40
E-428	1 1-2	3	2 1-4	6 9-16	4.40	10.20
E-429	1 1-2	4	2 1-4	7 5-8	4.40	10.75

List of Collets, pages 338 and 339.

List of Tapers, page 234.

## Coarse-Tooth Spiral End Mills

**HIGH-  
SPEED  
STEEL**



See page 240 for explanation of advantages of Coarse-Tooth Cutters  
In ordering, state whether Right- or Left-Hand Mills are wanted

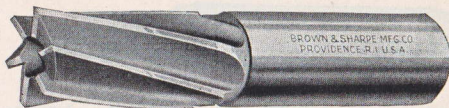
No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Price, Each High-Speed Steel
E-700	1-4	4	13-16	2 7-16	\$2.10
E-701	1-4	5	13-16	3	2.80
E-702	5-16	4	7-8	2 1-2	2.10
E-703	5-16	5	7-8	3 1-16	2.90
E-704	3-8	4	7-8	2 1-2	2.10
E-705	3-8	5	7-8	3 1-16	2.90
E-706	7-16	4	15-16	2 9-16	2.10
E-707	7-16	5	15-16	3 1-8	2.90
E-708	1-2	5	1	3 3-16	2.90
E-709	1-2	7	1 1-8	5 1-8	4.60
E-711	9-16	7	1 1-4	5 1-4	4.60
E-712	5-8	5	1 1-4	3 7-16	3.10
E-713	5-8	7	1 1-2	5 1-2	4.60
E-714	11-16	7	1 1-2	5 1-2	4.60
E-716	3-4	7	1 5-8	5 5-8	4.70
E-717	3-4	9	1 5-8	6 7-8	7.40
E-720	7-8	7	1 3-4	5 3-4	5.30
E-721	7-8	9	1 3-4	7	7.40
E-724	1	7	1 7-8	5 7-8	6.00
E-725	1	9	1 7-8	7 1-8	7.60
E-728	1 1-8	7	2	6	6.80
E-729	1 1-8	9	2	7 1-4	7.60
E-731	1 3-16	9	2	7 1-4	8.90
E-732	1 1-4	7	2	6	7.80
E-733	1 1-4	9	2	7 1-4	8.90
*E-733A	1 1-4	10	2 1-4	9 1-2	11.60
E-735	1 3-8	9	2 1-8	7 3-8	9.40
*E-735A	1 3-8	10	2 1-4	9 1-2	11.60
E-737	1 1-2	9	2 1-4	7 1-2	10.40
*E-737A	1 1-2	10	2 1-2	9 3-4	13.15
E-738	1 5-8	9	2 3-8	7 5-8	11.90
*E-738A	1 5-8	10	2 1-2	9 3-4	14.40
E-739	1 3-4	9	2 1-2	7 3-4	13.15
*E-739A	1 3-4	10	2 3-4	10	16.25
*E-740	2	10	2 3-4	10	20.50

List of Collets, see pages 338 and 339. List of Tapers, see page 234.

\*Made to order.

# Straight-Shank End Mills

For use with Spring Collets



These mills are for use with spring collets. The diameter of the shank is the same as diameter of cut taken. All mills less than 3-8" diameter have straight teeth and all mills 3-8" and over have spiral teeth.

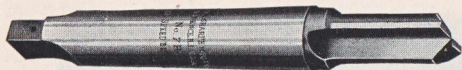
**In ordering, state whether Right- or Left-Hand Mills are wanted**

No.	Diameter, Inches	Length of Cut, Inches	Whole Length, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
E-650	1-8	5-16	1 1-4	\$0.70	\$1.00
E-651	5-32	5-16	1 1-4	.70	1.00
E-652	3-16	9-16	1 1-2	.70	1.00
E-653	7-32	9-16	1 1-2	.70	1.00
E-654	1-4	3-4	1 7-8	.80	1.15
E-655	9-32	3-4	1 7-8	.90	1.30
E-656	5-16	13-16	1 15-16	.90	1.30
E-658	3-8	13-16	2	1.00	1.50
E-660	7-16	7-8	2 1-8	1.25	1.90
E-661	1-2	15-16	2 1-4	1.60	2.40
E-662	9-16	15-16	2 5-16	1.70	2.65
E-663	5-8	1	2 3-8	1.80	2.80
E-665	3-4	1 1-8	2 15-16	2.15	3.50



# Slotting End Mills—"Two Lipped"

## HIGH-SPEED STEEL



**In ordering, state whether Right- or Left-Hand Mills are wanted**

These End Mills are found especially adaptable to rapidly milling slots in steel and iron from the solid, where previously it was necessary to drill a series of holes and make several cuts in milling the slot. A high surface speed is necessary to secure the best results.

A depth of cut equal to one-half the diameter of the mill can usually be taken from solid stock.

No.	Diameter, Inches	No. of Taper Shank	Length of Cut, Inches	Whole Length, Inches	Price, Each High-Speed Steel
E-597	1-4	4	3-8	2	\$1.65
E-598	1-4	5	3-8	2 1-2	2.80
E-599	5-16	5	15-32	2 19-32	2.80
E-600	1-4	7	3-8	4 3-8	4.15
E-601	5-16	7	15-32	4 15-32	4.15
E-602	3-8	7	9-16	4 9-16	4.60
E-603	7-16	7	21-32	4 21-32	4.60
E-604	1-2	7	3-4	4 3-4	4.60
E-605	9-16	7	27-32	4 27-32	4.60
E-606	5-8	7	15-16	4 15-16	4.60
E-607	11-16	7	1 1-32	5 1-32	4.60
E-608	3-4	7	1 1-8	5 1-8	4.60
E-610	13-16	7	1 7-32	5 7-32	5.30
E-612	7-8	7	1 5-16	5 5-16	5.30
E-613	7-8	9	1 5-16	6 9-16	7.40
E-614	15-16	9	1 13-32	6 21-32	7.40
E-615	1	9	1 1-2	6 3-4	7.40
E-617	1 1-8	9	1 11-16	6 15-16	7.40
E-619	1 1-4	9	1 7-8	7 1-8	8.90
E-621	1 3-8	9	2 1-16	7 5-16	9.40
E-623	1 1-2	9	2 1-4	7 1-2	10.40

List of Collets, pages 338 and 339. List of Tapers, page 234.

## Woodruff Key Seat Cutters



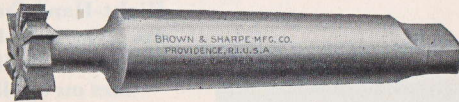
**Right-Hand Cutters only  
are carried in stock.  
Prices of Left-Hand Cut-  
ters on application**

Cutters for Keyways Nos. 126-129 inc., 26-29 inc., Rx to Vx inc., R to V inc., and 30-36 inc., can be furnished of the side milling type. Prices on application.

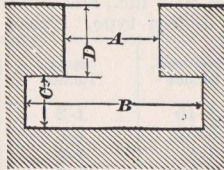
No.	Diameter, Inches	Thickness, Inches	Shank, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
*1	1-2	1-16	1-2	<b>\$1.20</b>	...
*2	1-2	3-32	1-2	<b>1.20</b>	...
3	1-2	1-8	1-2	<b>1.20</b>	<b>\$1.80</b>
4	5-8	3-32	1-2	<b>1.35</b>	<b>2.10</b>
5	5-8	1-8	1-2	<b>1.35</b>	<b>2.10</b>
6	5-8	5-32	1-2	<b>1.35</b>	<b>2.10</b>
7	3-4	1-8	1-2	<b>1.60</b>	<b>2.50</b>
8	3-4	5-32	1-2	<b>1.60</b>	<b>2.50</b>
9	3-4	3-16	1-2	<b>1.60</b>	<b>2.50</b>
10	7-8	5-32	1-2	<b>1.75</b>	<b>2.75</b>
11	7-8	3-16	1-2	<b>1.75</b>	<b>2.75</b>
12	7-8	7-32	1-2	<b>1.75</b>	<b>2.75</b>
A	7-8	1-4	1-2	<b>1.75</b>	<b>2.75</b>
13	1	3-16	1-2	<b>2.15</b>	<b>3.60</b>
14	1	7-32	1-2	<b>2.15</b>	<b>3.60</b>
15	1	1-4	1-2	<b>2.15</b>	<b>3.60</b>
B	1	5-16	1-2	<b>2.15</b>	<b>3.60</b>
16	1 1-8	3-16	1-2	<b>2.30</b>	<b>4.00</b>
17	1 1-8	7-32	1-2	<b>2.30</b>	<b>4.00</b>
18	1 1-8	1-4	1-2	<b>2.30</b>	<b>4.00</b>
C	1 1-8	5-16	1-2	<b>2.30</b>	<b>4.00</b>
19	1 1-4	3-16	1-2	<b>2.50</b>	<b>4.50</b>
20	1 1-4	7-32	1-2	<b>2.50</b>	<b>4.50</b>
21	1 1-4	1-4	1-2	<b>2.50</b>	<b>4.50</b>
D	1 1-4	5-16	1-2	<b>2.50</b>	<b>4.50</b>
E	1 1-4	3-8	1-2	<b>2.50</b>	<b>4.50</b>
22	1 3-8	1-4	1-2	<b>2.65</b>	<b>5.00</b>
23	1 3-8	5-16	1-2	<b>2.65</b>	<b>5.00</b>
F	1 3-8	3-8	1-2	<b>2.65</b>	<b>5.00</b>
24	1 1-2	1-4	1-2	<b>2.85</b>	<b>5.30</b>
25	1 1-2	5-16	1-2	<b>2.85</b>	<b>5.30</b>
G	1 1-2	3-8	1-2	<b>2.85</b>	<b>5.30</b>

\*Not made of High-Speed Steel.

## Standard T Slot Cutters



Left-Hand Cutter



In ordering, state whether Right- or Left-Hand Cutters are wanted

No. of Cutter	Width of Slot A, Inches	Diameter of Neck of Cutter, Inches	Width of Slot B, Inches	Depth C, Inches	Extreme Limit D, Inches	No. of Taper	Price, Each	
							Carbon Steel	High-Speed Steel
4	1-4	7-32	1-2	5-32	5-16	4	\$2.00	\$2.80
7	1-4	7-32	1-2	5-32	5-16	5	2.40	3.50
10	5-16	9-32	5-8	5-32	3-8	5	2.40	3.50
13	5-16	9-32	5-8	5-32	3-8	7	3.35	5.20
16	3-8	11-32	11-16	7-32	7-16	5	2.65	4.00
19	3-8	11-32	11-16	7-32	7-16	7	3.60	5.75
22	7-16	3-8	13-16	7-32	7-16	7	3.85	6.40
28	1-2	7-16	15-16	9-32	9-16	7	4.15	7.10
31	1-2	7-16	15-16	9-32	9-16	9	4.65	8.90
34	5-8	17-32	1 3-16	13-32	3-4	9	4.65	10.30
37	3-4	21-32	1 5-16	17-32	1 1-16	9	5.15	11.50
40	7-8	25-32	1 5-8	11-16	1 1-16	9	6.25	14.00

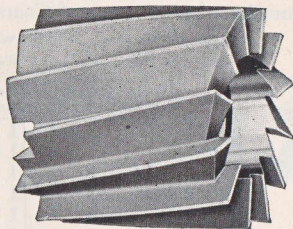
These cutters are made 1-32" larger in diameter and 1-64" greater in thickness than the figures given, to allow for sharpening.

Other sizes made to order.

List of Collets, pages 338 and 339. List of Tapers and Taper Holes, page 234.



## Spiral Shell End Mills



**Left-Hand Mill**

**In ordering, state whether Right- or Left-Hand Mills are wanted**

No.	Diameter, Inches	Length of Cut, Inches	No. of Arbor on which Cutter can be used	Hole, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
F-100	1 1-4	1 1-4	89	1-2	\$3.90	\$6.00
F-101	1 5-16	1 1-4		1-2	4.00	6.25
F-102	1 3-8	1 1-4		1-2	4.00	6.25
F-103	1 7-16	1 1-4		1-2	4.10	6.50
F-104	1 1-2	1 1-4		1-2	4.10	6.50
F-105	1 9-16	1 3-4	90	3-4	5.00	8.25
F-106	1 5-8	1 3-4		3-4	5.00	8.25
F-107	1 11-16	1 3-4		3-4	5.20	8.65
F-108	1 3-4	1 3-4		3-4	5.20	8.65
F-109	1 13-16	1 3-4		3-4	5.30	9.00
F-110	1 7-8	1 3-4	99	3-4	5.30	9.00
F-111	1 15-16	1 3-4		3-4	5.50	9.65
F-112	2	1 3-4		3-4	5.50	9.65
F-114	2 1-8	1 3-4		3-4	5.60	10.30
F-116	2 1-4	2 1-4		1	6.20	11.75
F-118	2 3-8	2 1-4	95	1	6.50	12.90
F-120	2 1-2	2 1-4		1	6.50	12.90
F-122	2 5-8	2 1-4		1	7.15	14.60
F-124	2 3-4	2 1-4		1	7.15	14.60
F-126	2 7-8	2 1-4		1	8.00	16.65
F-128	3	2 1-4	105	1	8.00	16.65

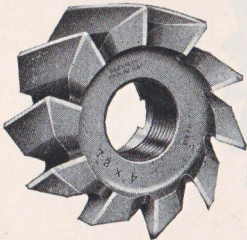
List of Arbors, page 336.

# Coarse-Tooth Spiral Shell End Mills

## HIGH-SPEED STEEL

See page 240 for explanation of advantages of Coarse-Tooth Cutters.

In ordering, state whether Right- or Left-Hand Mills are wanted.



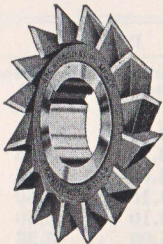
No.	Diam. Inches	Length of Cut, Inches	Hole, Inches	Hole Tapped, Thr. per Inch	Price, Each
F-200	2 1-2	1 1-4	1	10	\$9.25
F-201	3	1 3-4	1 1-4	8	14.50
F-202	3 1-2	2	1 1-2	8	20.80
F-203	4	2	1 1-2	8	24.70
F-204	5	2	1 1-2	8	35.20
F-205	6	2	1 1-2	8	53.50

List of Arbors, pages 334 and 335.

# Angular Cutters

These Angular Cutters of 45°, 50°, 60°, 70° or 80° angle, both right- and left-hand, are suitable for cutting the teeth of cutters and mills.

In ordering, state whether Right- or Left-Hand Cutters are wanted.



No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
J-10	2 1-2	1-2	7-8	\$3.40	\$5.80
J-11	2 3-4	1-2	1	3.60	6.40
J-12	3	1-2	1 1-4	4.30	7.65

List of Keyways, page 281.

# Angular Cutters with Threaded Holes

These cutters have an angle of 60° and are made both right- and left-hand.

In ordering, state whether Right- or Left-Hand Cutters are wanted.

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Thread	Price, Each	
					Carbon Steel	High-Speed Steel
J-25	1 1-4	7-16	3-8	20, L	\$3.00	\$4.75
J-26	1 5-8	9-16	1-2	16, L	3.60	5.80
*J-27	4	1 1-4	1 1-4	8, L	10.40	20.50

\*Left hand only.

List of Arbors, pages 334 and 335



## Double Angle Cutters

These Cutters are carried in stock with 45°, 60°, or 90° included angle.

V-shaped cutters of any angle made to order.

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
J-100	2 1-2	1-2	7-8	\$3.40	\$5.80
J-101	2 3-4	1-2	1	3.60	6.40
J-102	3	1-2	1 1-4	4.30	7.65

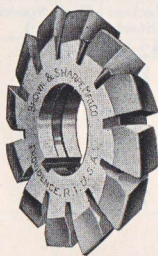
## Cutters for Spiral Mills

These Cutters are especially adapted to the cutting of spiral mills, and are made with either 40°, 48°, or 53° angle on one side and 12° on the other.

**In ordering, state whether Right- or Left-Hand Cutters are wanted**

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
J-150	2 1-2	1-2	7-8	\$3.40	\$5.80
J-151	2 3-4	1-2	1	3.60	6.40
J-152	3	1-2	1 1-4	4.30	7.65
*J-153	3 1-4	1-2	1 1-2	4.80	8.50

\*Furnished 53° on one side and 12° on the other.



## Angular Cutters and Cutters for Spiral Mills

### WITH BACKED-OFF TEETH

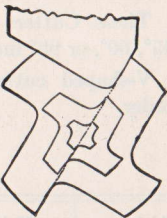
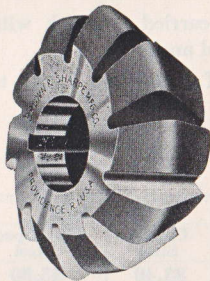
These cutters can be sharpened by grinding without changing their form.

Made to order.

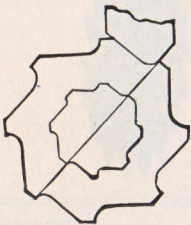
List of Keyways, page 281.



Cutters for Grooving Taps and Reamers



Form of Tap



Form of Reamer

These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter, or diameter and number of teeth of tap or reamer.

For Grooving Taps

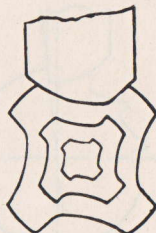
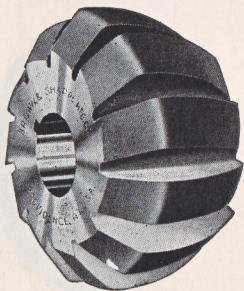
Catalog No.	Cutter No.	Diameter of Tap, Inches	Number of Teeth in Tap	Diameter of Cutter, Inches	Hole, Inches	Price, Each	
						Carbon Steel	High-Speed Steel
L-10	1	0 to 1-8	4	2	1	\$2.30	\$3.40
L-11	2	5-32 to 1-4	4	2	1	2.70	4.00
L-12	3	9-32 to 3-8	4	2 1-8	1	3.75	5.90
L-13	4	7-16 to 5-8	4	2 1-4	1	4.00	6.40
L-14	5	11-16 to 7-8	4	2 3-8	1	4.80	8.00
L-15	6	15-16 to 1 1-4	4	2 1-2	1	5.10	8.60
L-16	7	1 5-16 to 1 5-8	4	2 5-8	1	6.40	11.25
L-17	8	1 11-16 to 2	4	2 7-8	1	7.25	13.15

For Grooving Reamers

Catalog No.	Cutter No.	Diameter of Reamer, Inches	Number of Teeth in Reamer	Diameter of Cutter, Inches	Hole, Inches	Price, Each	
						Carbon Steel	High-Speed Steel
L-10	1	1-8 to 1-4	6	2	1	\$2.30	\$3.40
L-11	2	9-32 to 3-8	6	2	1	2.70	4.00
L-12	3	13-32 to 1-2	6	2 1-8	1	3.75	5.90
L-13	4	17-32 to 1 1-8	6 to 8	2 1-4	1	4.00	6.40
L-14	5	1 5-32 to 1 3-4	8 to 10	2 3-8	1	4.80	8.00
L-15	6	1 25-32 to 2	10	2 1-2	1	5.10	8.60
L-16	7	2 1-16 to 2 1-2	10	2 5-8	1	6.40	11.25
L-17	8	2 9-16 to 3	10	2 7-8	1	7.25	13.15

List of Keyways, page 281.

## Cutters for Grooving Taps



Form of Tap

This style of cutter is adapted to grooving taps only. These cutters do not make so deep a groove in proportion to the width as the tap and reamer cutters. They are not suitable for fluting reamers. See cut.

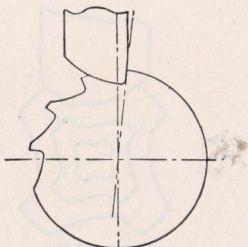
These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter or diameter of tap.

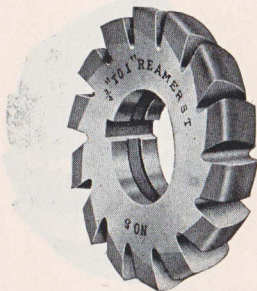
Catalog No.	Cutter No.	Diameter of Tap, Inches	Diameter of Cutter, Inches	Hole, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
L-50	1	0 to 1-8	2	1	\$2.30	\$3.40
L-51	2	5-32 to 1-4	2	1	2.70	4.00
L-52	3	9-32 to 3-8	2 1-8	1	3.65	5.65
L-53	4	7-16 to 5-8	2 1-4	1	3.85	6.10
L-54	5	11-16 to 7-8	2 3-8	1	4.80	8.00
L-55	6	15-16 to 1 1-4	2 1-2	1	5.10	8.60
L-56	7	1 5-16 to 1 5-8	2 5-8	1	6.40	11.25
L-57	8	1 11-16 to 2	2 7-8	1	7.50	13.65
L-58	9	2 1-16 to 2 7-16	3 1-8	1	8.85	16.75
L-59	10	2 1-2 to 3	3 3-8	1	10.80	21.65

List of Keyways, page 281.

## Cutters for Fluting Reamers



Form of Reamer



The cut shows a form of cutter that makes a tooth that allows the chips to be removed more readily and has greater strength than the form made by the cutters for grooving taps and reamers.

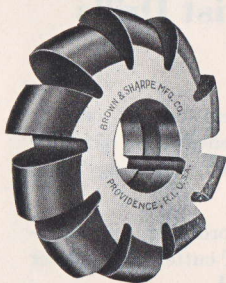
In ordering, give number of cutter or diameter of reamer.

Catalog No.	Cutter No.	Diameter of Reamer, Inches	Number of Teeth	Hole, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
L-75	1	1-8 to 3-16	6	1	\$2.70	\$4.00
L-76	2	1-4 to 5-16	6	1	3.50	5.30
L-77	3	3-8 to 7-16	6	1	3.70	5.75
L-78	4	1-2 to 11-16	6 to 8	1	4.00	6.40
L-79	5	3-4 to 1	8	1	4.20	6.70
L-80	6	1 1-16 to 1 1-2	10	1	4.40	7.15
L-81	7	1 9-16 to 2 1-8	12	1	4.80	8.00
L-82	8	2 1-4 to 3	14	1	5.60	9.60
L-83	9	3 1-16 to 3 1-2	14	1	6.60	11.60
L-84	10	3 9-16 to 5	14 to 16	1	7.70	13.90

List of Keyways, page 281.



## Cutters for Making Twist Drills



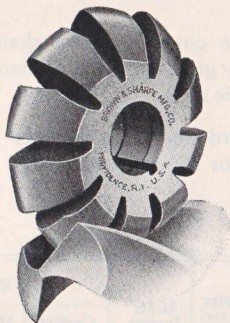
These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter or diameter of drill.

Catalog No.	Cutter No.	Diameter of Drill, Inches	Diam. of Circle Made by Cutter, Inches	Diameter of Cutter, Inches	Hole, Inches	Price, Each	
						Carbon Steel	High-Speed Steel
L-100	1	1-16	.06	2	1	\$2.10	\$3.15
L-101	2	1-8	.08	2	1	2.30	3.40
L-102	3	3-16	.11	2	1	2.30	3.40
L-103	4	1-4	.15	2	1	2.70	4.00
L-104	5	5-16	.19	2 1-4	1	2.85	4.40
L-105	6	3-8	.23	2 1-4	1	3.65	5.65
L-106	7	7-16	.27	2 1-4	1	3.75	5.90
L-107	8	1-2	.31	2 1-4	1	3.75	5.90
L-108	9	9-16	.35	2 3-8	1	4.20	6.75
L-109	10	5-8	.39	2 3-8	1	4.35	7.10
L-110	11	11-16	.44	2 3-8	1	4.35	7.10
L-111	12	3-4	.50	2 1-2	1	4.50	7.30
L-112	13	13-16	.56	2 1-2	1	4.80	8.00
L-113	14	7-8	.62	2 3-4	1	5.15	8.75
L-114	15	15-16	.70	2 3-4	1	5.60	9.60
L-115	16	1	.77	3	1	6.60	11.60
L-116	17	1 1-8	.85	3	1	6.60	11.60

List of Keyways, page 281.

## Cutters for Making Straight-Lipped Twist Drills

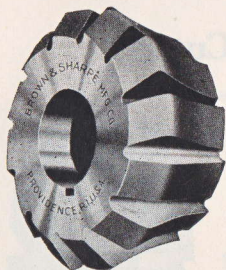


These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter or diameter of drill.

Catalog No.	Cutter No.	Diameter of Drill, Inches	Diameter of Cutter, Inches	Hole, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
L-200	1	1-16	2	1	\$2.10	\$3.15
L-201	2	1-8	2	1	2.30	3.40
L-202	3	3-16	2	1	2.70	4.00
L-203	4	1-4	2	1	2.70	4.00
L-204	5	5-16	2 1-4	1	3.65	5.65
L-205	6	3-8	2 1-4	1	3.75	5.90
L-206	7	7-16	2 1-4	1	3.85	6.10
L-207	8	1-2	2 1-4	1	3.85	6.10
L-208	9	9-16	2 5-8	1	4.60	7.65
L-209	10	5-8	2 5-8	1	4.80	8.00
L-210	11	11-16	2 5-8	1	5.15	8.75
L-211	12	3-4	2 5-8	1	5.15	8.75
L-212	13	13-16	2 7-8	1	5.60	9.65
L-213	14	7-8	2 7-8	1	6.10	10.65
L-214	15	15-16	2 7-8	1	6.10	10.65
L-215	16	1	3	1	6.10	10.65
L-216	17	1 1-8	3	1	6.60	11.60
L-217	18	1 1-4	3 1-4	1	7.70	13.90
L-218	19	1 1-2	3 3-4	1 1-4	9.60	17.90
L-219	20	1 3-4	3 3-4	1 1-4	10.20	19.60
L-220	21	2	4	1 1-4	11.40	22.50
L-221	22	2 1-4	4 1-4	1 1-4	13.00	26.65
L-222	23	2 1-2	4 1-2	1 1-4	14.65	31.25

List of Keyways, page 281.



## Cutters for Making Four-Lipped Twist Drills

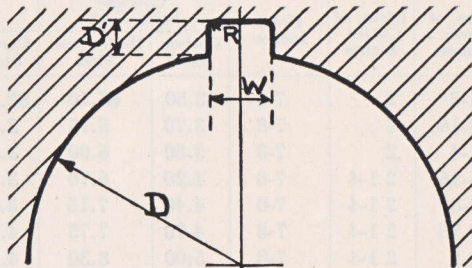
These cutters are especially adapted to cutting Four-Lipped Twist Drills that are used in screw and chucking machines for roughing out holes previous to reaming, and can be sharpened by grinding without changing their form.

In ordering, give number of cutter or size of drill.

Catalog No.	Cutter No.	Diameter of Drill, Inches	Diameter of Cutter, Inches	Hole, Inches	Price, Each	
					Carbon Steel	High-Speed Steel
L-250	1	0 to 1 1-2	2 3-4	1	\$6.90	\$12.30
L-251	2	1 1-2 to 3	3	1	9.85	19.50

List of Keyways, see table below.

## Standard Keyways for Cutters



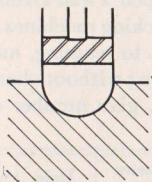
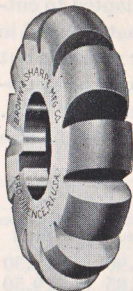
Diameter (D) of Hole, Inches	Width (W) of Keyway, In.	Depth (D') of Keyway, In.	Radius (R), Inches
3-8 to 9-16	3-32	3-64	.020
5-8 to 7-8 or 16 m/m to 21 m/m	1-8	1-16	.030
15-16 to 1 1-8 or 22 " to 26 "	5-32	5-64	.035
1 3-16 to 1 3-8 or 27 " to 31 "	3-16	3-32	.040
1 7-16 to 1 3-4* or 32 " to 37 "	1-4	1-8	.050
1 13-16 to 2* or 38 " to 44 "	5-16	5-32	.060
2 1-16 to 2 1-2 or 45 "	3-8	3-16	.060
2 9-16 to 3	7-16	3-16	.060

\*1 1-2", 1 3-4" and 2". For all Gear and Stocking Cutters of these diameters, use 5-16", 3-8" and 1-2" keys, respectively, Gear and Stocking Cutters with 1 1-2" hole can also be furnished with 3-8" keyway.

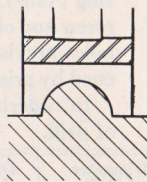


## Convex and Concave Cutters

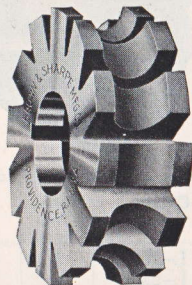
For Milling Half Circles



Convex



Concave

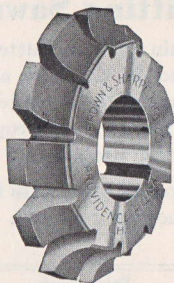


These cutters can be sharpened by grinding without changing their outline.

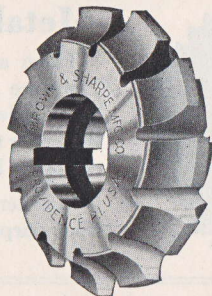
No.	Diam. of Circle, Inches	Diam. of Cutter Inches	Hole, Inches	Concave Price, Each		Convex Price, Each	
				Carbon Steel	High-Speed Steel	Carbon Steel	High-Speed Steel
C-10	1-8	2	7-8	\$3.50	\$5.30	\$2.30	\$3.40
C-11	3-16	2	7-8	3.70	5.75	2.70	4.00
C-12	1-4	2	7-8	3.80	6.00	3.50	5.30
C-13	5-16	2 1-4	7-8	4.20	6.70	3.75	5.90
C-14	3-8	2 1-4	7-8	4.40	7.15	3.85	6.10
C-15	7-16	2 1-4	7-8	4.70	7.75	4.00	6.40
C-16	1-2	2 1-4	7-8	5.00	8.30	4.20	6.70
C-17	5-8	2 3-4	1	6.40	11.25	5.15	8.75
C-18	3-4	3	1	7.50	13.65	6.10	10.65
C-19	7-8	3 1-4	1	8.60	16.00	7.15	12.75
C-20	1	3 1-4	1	9.10	17.50	7.70	13.90
C-21	1 1-8	4	1 1-4	12.00	24.40	10.40	19.65
C-22	1 1-4	4	1 1-4	12.65	26.15	10.75	20.65
C-23	1 3-8	4 1-4	1 1-4	14.85	31.40	11.90	23.50
C-24	1 1-2	4 1-4	1 1-4	16.15	34.40	12.25	24.50

List of Keyways, page 281.

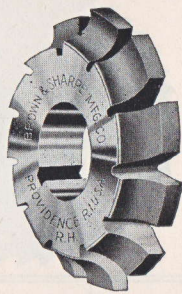
## Corner-Rounding Cutters



Left Hand



Double



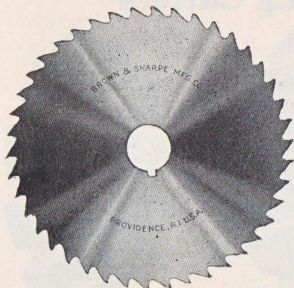
Right Hand

These cutters have side as well as radial clearance and can be ground without changing their outline.

**In ordering single cutters, state whether Right-or Left-Hand Cutters are wanted.**

No.	Radius of Circle, Inches	Diameter, Inches	Hole, Inches	Price, Each			
				Carbon Steel		High-Speed Steel	
				Single Cutters	Double Cutters	Single Cutters	Double Cutters
C-100	1-16	2	7-8	\$2.30	\$2.70	\$3.40	\$4.00
C-102	1-8	2	7-8	3.50	3.70	5.30	5.75
C-104	3-16	2 1-4	7-8	3.75	4.20	5.90	6.70
C-106	1-4	2 1-4	7-8	4.00	4.70	6.40	7.75
C-107	5-16	2 3-4	1	4.80	6.00	8.00	10.40
C-108	3-8	3	1	5.60	7.00	9.65	12.40
C-109	7-16	3 1-4	1	6.60	7.90	11.65	14.50
C-110	1-2	3 1-4	1	7.15	8.60	12.75	16.00
C-112	5-8	3 1-2	1	8.70	9.85	16.10	19.20

List of Keyways, page 281.



## Metal Slitting Saws

These are thin Milling Cutters. They are ground on the sides and left a little thicker at the outer edge than near the center to give a proper clearance in cutting deep slots.

In ordering *special* saws state for what purpose they are required.

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
G-50	2 1-2	1-32	7-8	\$1.30	\$3.15
G-51	2 1-2	3-64	7-8	1.20	3.00
G-52	2 1-2	1-16	7-8	1.15	3.00
G-53	2 1-2	3-32	7-8	1.15	3.00
G-54	2 1-2	1-8	7-8	1.15	3.00
G-55	2 1-2	5-32	7-8	1.65	3.25
G-56	3	1-32	1	1.60	3.75
G-57	3	3-64	1	1.50	3.25
G-58	3	1-16	1	1.30	3.15
G-59	3	3-32	1	1.30	3.15
G-60	3	1-8	1	1.30	3.15
G-61	3	5-32	1	1.75	3.60
G-62	4	1-32	1	2.85	5.75
G-63	4	3-64	1	1.85	4.00
G-64	4	1-16	1	1.60	3.75
G-65	4	3-32	1	1.60	3.60
G-66	4	1-8	1	1.60	3.60
G-67	4	5-32	1	2.10	4.65
G-68	4	3-16	1	2.10	4.65
G-69	5	1-16	1	2.30	5.15
G-70	5	3-32	1	2.00	4.70
G-71	5	1-8	1	2.00	5.20

List continued on next page.

List of Keyways, page 281.



## Metal Slitting Saws

(Continued)

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Price, Each	
				Carbon Steel	High-Speed Steel
G-72	5	1-8	1 1-4	\$2.00	\$5.20
G-73	5	1-8	1 1-2	2.00	5.20
G-74	5	5-32	1	2.90	7.40
G-75	5	3-16	1	2.90	7.40
G-76	6	1-16	1	5.10	9.40
G-77	6	3-32	1	3.85	7.65
G-78	6	1-8	1	3.50	7.70
G-78A	6	1-8	1 1-4	3.50	7.70
G-79	6	3-16	1 1-2	4.50	10.20
G-80	6	3-16	1	4.50	10.20
G-81	7	1-16	1	9.50	16.00
G-82	7	3-32	1	5.70	10.75
G-83	7	1-8	1	4.85	10.80
G-83A	7	3-16	1 1-4	6.50	14.70
G-83C	7	3-16	2	6.50	14.70
G-84	8	1-8	1	7.30	15.00
G-85	8	1-8	1 1-4	7.30	15.00
G-86	8	3-16	1 1-4	8.90	18.90
G-87	8	3-16	1 1-2	8.90	18.90

List of Keyways, page 281.

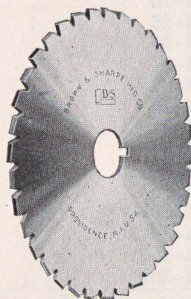
## Formed Saws for Slitting Copper

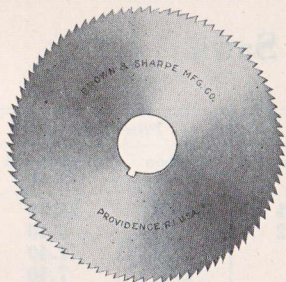
These saws are designed especially for the slitting or sawing of metals that are of a soft or tenacious character and are superior to the ordinary saw usually employed for this purpose.

The teeth are backed off and formed the same as in all formed milling cutters, and are sharpened by grinding the face, thus retaining the outline of the saw. Each alternate tooth is V shaped, and, as the others are flat, the chip is split and forced out sidewise, having less tendency to clog than where the ordinary saw is employed.

The sides are ground concave for clearance.

These saws are made to order of any desired size.





## Screw Slotting Cutters

These cutters have a fine pitch of teeth especially adapted to the slotting of screw heads and similar work.

They are not ground on the sides.

Cutters 2 3-4" diam. have 72 teeth, 2 1-4" diam., 60 teeth and 1 3-4" diam., 90 teeth.

Catalog No.	Screw Head to be Slotted, Diam., Inches	Gauge No. American Standard	Thickness of Cutter, Inches	Diameter Cutter, Inches	Hole, Inches	Price, Each
H-10	1 5-16	5	.182	2 3-4	1	\$0.90
H-11	1 1-8	6	.162	2 3-4	1	.75
H-12	1	7	.144	2 3-4	1	.65
H-13	7-8	8	.128	2 3-4	3-4, 1	.55
H-14	3-4 to 13-16	9	.114	2 3-4	3-4, 1	.50
H-15	5-8	10	.102	2 3-4	3-4, 1	.45
H-16	...	11	.091	2 3-4	3-4, 1	.40
H-17	1-2 to 9-16	12	.081	2 3-4	3-4, 1	.35
H-18	...	13	.072	2 3-4	3-4, 1	.35
H-19	3-8 to 7-16	14	.064	2 3-4	1-2, 5-8, 3-4, 1	.35
H-20	11-32	15	.057	2 3-4	1-2, 5-8, 3-4, 1	.30
H-21	5-16	16	.051	2 3-4	1-2, 5-8, 3-4, 1	.30
H-22	...	17	.045	2 3-4	1-2, 5-8, 3-4, 1	.25
H-23	1-4 to 9-32	18	.040	2 3-4	1-2, 5-8, 3-4, 1	.25
H-24	3-16 to 7-32	19	.035	2 3-4	1-2, 5-8, 3-4, 1	.25
H-25	...	20	.032	2 3-4	1-2, 5-8, 3-4, 1	.25
H-26	1-8	21	.028	2 3-4	1-2, 5-8, 3-4, 1	.20
H-27	1-8	22	.025	2 3-4	1-2, 5-8, 3-4, 1	.20
H-28	...	23	.023	2 3-4	1-2, 5-8, 3-4, 1	.20
H-29	...	24	.020	2 3-4	1-2, 5-8, 3-4, 1	.20
H-30	...	25	.018	2 3-4	1-2, 5-8, 3-4, 1	.20
H-31	...	26	.016	2 3-4	3-4, 1	.20
H-32	...	27	.014	2 3-4	3-4, 1	.20
H-33	...	28	.012	2 3-4	3-4, 1	.20
H-34	...	30	.010	2 3-4	3-4, 1	.20
H-35	...	32	.008	2 3-4	3-4, 1	.20
H-36	...	34	.006	2 3-4	3-4, 1	.20
H-36A	...	10	.102	2 1-4	5-8	.40
H-36B	...	11	.091	2 1-4	5-8	.35
H-36C	...	12	.081	2 1-4	5-8	.30
H-36D	...	13	.072	2 1-4	5-8	.25
H-36E	...	14	.064	2 1-4	5-8	.25

List continued on next page.

List of Keyways, page 281.

## Screw Slotting Cutters *(Continued)*

Catalog No.	Diameter of Screw Head to be Slotted, Inches	Gauge No. American Standard	Thickness of Cutter, Inches	Diameter of Cutter, Inches	Hole, Inches	Price, Each
H-36F	...	15	.057	2 1-4	5-8	\$.20
H-36G	...	16	.051	2 1-4	5-8	.20
H-36H	...	17	.045	2 1-4	5-8	.20
H-36I	...	18	.040	2 1-4	5-8	.20
H-36J	...	19	.035	2 1-4	5-8	.20
H-37	3-16	20	.032	2 1-4	5-8	.20
H-38	1-8	21	.028	2 1-4	5-8	.20
H-39	...	22	.025	2 1-4	5-8	.20
H-40	...	23	.023	2 1-4	5-8	.20
H-41	...	24	.020	2 1-4	5-8	.20
H-42	...	25	.018	2 1-4	5-8	.20
H-43	...	26	.016	2 1-4	5-8	.20
H-44	...	27	.014	2 1-4	5-8	.20
H-45	...	28	.012	2 1-4	5-8	.20
H-46	...	30	.010	2 1-4	5-8	.20
H-47	...	32	.008	2 1-4	5-8	.20
H-48	...	34	.006	2 1-4	5-8	.20
H-49	3-8	14	.064	1 3-4	5-8	.20
H-50	11-32	15	.057	1 3-4	5-8	.20
H-51	5-16	16	.051	1 3-4	5-8	.20
H-52	9-32	17	.045	1 3-4	5-8	.20
H-53	1-4	18	.040	1 3-4	5-8	.20
H-54	7-32	19	.035	1 3-4	5-8	.20
H-55	3-16	20	.032	1 3-4	5-8	.20
H-56	1-8	21	.028	1 3-4	5-8	.20
H-57	...	22	.025	1 3-4	5-8	.20
H-58	...	23	.023	1 3-4	5-8	.20
H-59	...	24	.020	1 3-4	1-2, 5-8	.15
H-60	...	25	.018	1 3-4	1-2, 5-8	.15
H-61	...	26	.016	1 3-4	1-2, 5-8	.15
H-62	...	27	.014	1 3-4	1-2, 5-8	.15
H-63	...	28	.012	1 3-4	1-2, 5-8	.15
H-64	...	30	.010	1 3-4	1-2, 5-8	.15
H-65	...	32	.008	1 3-4	1-2, 5-8	.15
H-66	...	34	.006	1 3-4	1-2, 5-8	.15

Other sizes made to order.

Screw Slotting Cutter Arbors, page 333. List of Keyways, page 281.

## Jewelers' Saws

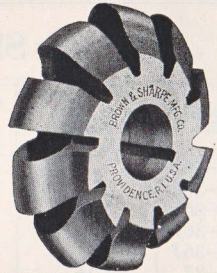
Many of the Screw Slotting Cutters listed above are suitable for jewelers' use in sawing chain links, etc.



# Sprocket Wheel Cutters for Roller Chains

American Standard Tooth Forms  
Adopted by S.A.E., A.S.M.E., A.G.M.A.

Not carried in stock but can  
be furnished at short notice



Circular Pitch, Inches	Diam. of Roll, Inches	No. of Teeth in Sprocket	Diam. of Cutter, Inches	Width of Cutter, Inches	Size of Hole, Inches	Price, Each	
						Carbon Steel	High-Speed Steel
3-8	.200	6	2 3-4	15-32	1	\$4.80	\$8.00
		7 to 8	2 3-4	15-32		4.80	8.00
		9 to 11	2 3-4	15-32		4.80	8.00
		12 to 17	2 3-4	7-16		4.60	7.65
		18 to 34	2 3-4	7-16		4.60	7.65
		35 and over	2 3-4	13-32	1	4.60	7.65
		6	3	3-4		6.10	10.65
		7 to 8	3	3-4		6.10	10.65
		9 to 11	3 1-8	3-4		6.60	11.65
		12 to 17	3 1-8	3-4		6.60	11.65
1-2 to 5-8	.313	18 to 34	3 1-8	23-32	1	6.60	11.65
		35 and over	3 1-8	11-16		6.60	11.65
		6	3 1-8	3-4		6.60	11.65
		7 to 8	3 1-8	3-4		6.60	11.65
		9 to 11	3 1-4	3-4	1	6.60	11.65
5-8	.400	12 to 17	3 1-4	3-4		6.60	11.65
		18 to 34	3 1-4	23-32		6.60	11.65
		35 and over	3 1-4	11-16		6.60	11.65
		6	3 1-4	29-32		7.70	13.90
		7 to 8	3 1-4	29-32	1	7.70	13.90
		9 to 11	3 3-8	29-32		8.50	15.50
		12 to 17	3 3-8	7-8		7.85	14.15
		18 to 34	3 3-8	27-32		7.85	14.15
		35 and over	3 3-8	13-16		7.85	14.15
3-4	.469	6	3 3-4	11-14	1	9.85	18.75
		7 to 8	3 7-8	11-14		10.75	20.65
		9 to 11	3 7-8	13-16		10.75	20.65
		12 to 17	4	15-32	1 1-4	10.75	20.65
		18 to 34	4	11-8		10.40	19.65
1	.563	35 and over	4	13-32		10.40	19.65

List continued on next page.

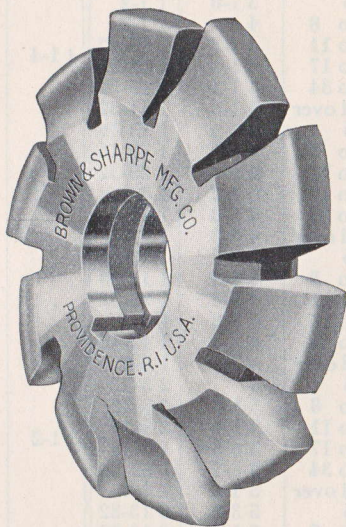
List of Keyways, page 281.

# Sprocket Wheel Cutters (Continued)

Circular Pitch, Inches	Diam. of Roll, Inches	No. of Teeth in Sprocket	Diam. of Cutter, Inches	Width of Cutter, Inches	Size of Hole, Inches	Price, Each	
						Carbon Steel	High-Speed Steel
1 to 1 1-4	.625	6	3 7-8	1 1-2	1 1-4	\$11.40	\$22.50
		7 to 8	4	1 1-2		11.40	22.50
		9 to 11	4 1-8	1 15-32		12.25	24.50
		12 to 17	4 1-8	1 15-32		12.25	24.50
		18 to 34	4 1-4	1 13-32		12.25	24.50
1 1-4 to 1 1-2	.750	35 and over	4 1-4	1 11-32	1 1-4	11.90	23.50
		6	4 1-4	1 13-16		13.65	28.65
		7 to 8	4 3-8	1 13-16		14.65	31.25
		9 to 11	4 1-2	1 25-32		14.65	31.25
		12 to 17	4 1-2	1 3-4		13.85	28.90
1 1-2	.875	18 to 34	4 5-8	1 11-16	1 1-4	14.85	31.25
		35 and over	4 5-8	1 5-8		14.50	30.15
		6	4 3-8	1 13-16		14.65	31.25
		7 to 8	4 1-2	1 13-16		14.65	31.25
		9 to 11	4 5-8	1 25-32		15.75	33.90
1 3-4	1.000	12 to 17	4 5-8	1 3-4	1 1-4	14.85	31.25
		18 to 34	4 3-4	1 11-16		14.85	31.25
		35 and over	4 3-4	1 5-8		14.50	30.15
		6	5	2 3-32		18.50	40.50
		7 to 8	5 1-8	2 3-32	1 1-2	19.70	44.90
2	1.125	9 to 11	5 1-4	2 1-16		19.70	44.90
		12 to 17	5 3-8	2 1-32		21.00	48.30
		18 to 34	5 1-2	1 31-32		19.10	43.75
		35 and over	5 1-2	1 7-8		19.10	43.75
		6	5 3-8	2 13-32	1 1-2	23.00	53.00
2 1-2	1.550	7 to 8	5 1-2	2 13-32		23.00	53.00
		9 to 11	5 5-8	2 3-8		24.50	57.00
		12 to 17	5 3-4	2 5-16		24.50	57.00
		18 to 34	5 7-8	2 1-4		23.80	57.75
		35 and over	5 7-8	2 5-32		23.80	57.75
2 1-2	1.550	6	6 3-8	3	1 3-4	34.80	85.65
		7 to 8	6 5-8	3		37.00	91.50
		9 to 11	6 3-4	2 15-16		37.00	91.50
		12 to 17	6 7-8	2 29-32		39.50	97.90
		18 to 34	7	2 3-4		36.40	90.30
3	1.900	35 and over	7 1-8	2 11-16	2	38.90	96.60
		6	7 1-2	3 19-32		58.85	142.65
		7 to 8	7 3-4	3 19-32		59.60	147.40
		9 to 11	7 7-8	3 17-32		63.50	157.00
		12 to 17	8	3 15-32		59.15	146.65
		18 to 34	8	3 11-32		59.15	146.65
		35 and over	8 1-4	3 7-32		58.20	150.80

List of Keyways, page 281.

## Gear Cutters

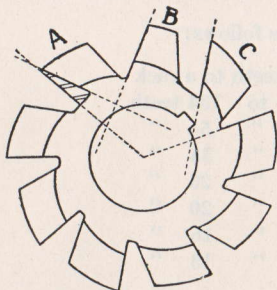


These cutters for the teeth of gears are so made that they can be sharpened by grinding the faces of the teeth, and this operation can be repeated without altering the form of the tooth which the cutter makes.

Orders should be given by the following tables, stating the number of cutter and the diametral pitch required. By diametral pitch is meant the number of teeth in a gear per inch of pitch diameter. In ordering cutters for worm gears, give the number of teeth in gear, the diameter of worm, and number of threads to the inch.



## Sharpening Gear and Formed Cutters



**F**OR economy, cutters must be kept well sharpened. Sharp cutters give faster production, consume less power, produce better surfaces and wear longer. Use a bevel and concave wheel of medium grain and soft grade, just hard enough to prevent the grit flying about. Keep the wheel clean, as a glazed wheel draws the cutter temper, also keep the corner sharp to give a true surface the entire length of the cutter tooth.

In grinding the cutter, the face of every tooth must be kept radial, and all must be of the same height. When not ground radi-

ally, they are either "hooking," like C which cuts too deep, or "dragging," as B which cuts too shallow. Besides this, all cutter teeth are relieved so that the cutting outline of the tooth remains correct only when ground radially. Hence such teeth as A, B, and C will cut gear teeth of the wrong shape. Be careful also to keep each tooth face square with the sides of the cutter, avoiding mistakes like A. If some of the teeth are longer than others, the long teeth will do all the cutting. In this connection the Cutter Testing Fixture shown on page 399 will be found of particular value.

## To Set a Gear Cutter Central

**T**HE indicator furnished with our Automatic Gear Cutting Machine allows settings sufficiently accurate for ordinary work. When a very accurate and quiet-running gear is required, however, it is absolutely essential that the cutter be exactly central.

The best method of setting the cutter central is first to turn a blank identical in diameter with the gear to be cut, and, after centering it as nearly as possible, take a single cut through the blank. Without changing the position of the cutter, remove the blank from the work arbor and turn it end for end. Leave the blank loose on the arbor and feed the cutter into the slot already cut. Then revolve the cutter by pulling the belt so as to mark its position in relation to the slot produced at the first cut.

If the cutter is exactly central, the second cut will follow the outline of the first; but if out of center, the cutter at its second passage will cut some stock from the top of the space on one side and from the bottom on the other side. In the latter case the cutter should be moved laterally away from the side of the tooth from which the stock was taken at the deepest part of cut and another cut taken in another part of the blank, and the above operations repeated until the cutter is properly centered.

## Involute Gear Cutters

Eight Cutters are made for each pitch, as follows:

No. 1	will cut gears from 135 teeth to a rack
" 2	" " " " 55 to 134 teeth
" 3	" " " " 35 " 54 "
" 4	" " " " 26 " 34 "
" 5	" " " " 21 " 25 "
" 6	" " " " 17 " 20 "
" 7	" " " " 14 " 16 "
" 8	" " " " 12 " 13 "

We are prepared to furnish to order Gear Cutters from 2 to 8 pitch, inclusive of half numbers, for the accommodation of those who require a finer division of the number of teeth to be cut with each cutter than can be cut with the regular number.

The Nos. 1 to 8, as listed above, are the regular cutters as furnished. The half numbers are as follows:

No. of Cutter	Range, Teeth	No. of Cutter	Range, Teeth
1 1-2	80 to 134	5 1-2	19 to 20
2 1-2	42 " 54	6 1-2	15 " 16
3 1-2	30 " 34	7 1-2	13
4 1-2	23 " 25		

*Prices for half numbers on application.*

In ordering, give the number of cutter and diametral pitch required. Cutters in stock can be ordered by telegraph.

**Form of Telegram:**—Send one Cutter No. 5, 8 pitch (Carbon Steel or High-Speed Steel).

When ordering Cutters for Bevel Gears note instructions given on pages 296 and 297.



## Involute Gear Cutters

All gears of same pitch cut with these cutters are interchangeable.

Cutters for pitches not given in the list below will be made to order.

Eight cutters made for each pitch; see page 292.

Pitch	Diameter of Cutter, Inches		Hole, Inches	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
*1	8 1-2	8 1-2	2	\$57.00	\$135.65
*1 1-4	7 3-4	7 3-4	2	48.00	116.65
*1 1-2	7	7	1 3-4	40.50	86.90
1 3-4	6 1-2	6 1-2	1 3-4	30.35	63.75
2	5 3-4	5 3-4	1 1-2	20.25	43.75
2 1-2	5 1-2	5 3-4	1 1-2	13.90	33.15
3	4 3-8	4 3-4	1 1-4	10.10	22.50
4	3 7-8	4 1-4	1 1-4	7.60	15.35
5	3 5-8	3 3-4	1 1-4	6.90	12.50
6	3	3 1-8	1	5.50	10.00
7	2 7-8	2 7-8	1	5.15	8.75
8	2 7-8	2 7-8	1	5.00	8.50
9	2 3-4	2 3-4	1	4.70	7.65
10	2 1-4	2 3-8	7-8	4.50	7.10
11	2 1-4	2 3-8	7-8	4.20	6.65
12	2 1-8	2 1-4	7-8	3.90	6.00
14	2	2 1-8	7-8	3.40	5.65
16	2	2 1-8	7-8	3.20	5.25
18	1 7-8	2	7-8	3.00	4.70
20	1 7-8	2	7-8	2.90	4.60
22	1 7-8	2	7-8	2.80	4.50
24	1 3-4	1 3-4	7-8	2.65	4.25
26	1 3-4	1 3-4	7-8	2.60	4.20
28	1 3-4	1 3-4	7-8	2.25	3.75
30	1 3-4	1 3-4	7-8	2.25	3.75
32	1 3-4	1 3-4	7-8	2.25	3.75
36	1 3-4	1 3-4	7-8	2.25	3.75
40	1 3-4	1 3-4	7-8	2.25	3.75
48	1 3-4	1 3-4	7-8	2.25	3.75

Cutters marked \* are not kept in stock, but are made to order.

List of Keyways, page 281.



## Involute Gear Cutters

Cutters for pitches not given in the list below will be made to order. Eight cutters made for each pitch, see page 292. 3 pitch and coarser in Cast Iron and 4 pitch and coarser in Steel require 2 cuts to insure accuracy.

### FOR USE ON NO. 3 AUTOMATIC GEAR CUTTING MACHINES

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
4	3 1-2	3 5-8	1	5-32 x 5-64	\$7.00	\$13.65
5	3 1-4	3 3-8	1	5-32 x 5-64	6.00	11.15
6	3	3 1-8	1	5-32 x 5-64	5.50	10.00
7	2 7-8	2 7-8	1	5 32 x 5 64	5.15	8.75
8	2 7-8	2 7-8	1	5 32 x 5 64	5.00	8.50
9	2 3-4	2 3-4	1	5-32 x 5-64	4.70	7.65
10	2 3-4	2 3-4	1	5-32 x 5-64	4.60	7.30
11	2 5-8	2 5-8	1	5-32 x 5-64	4.50	7.10
12	2 5-8	2 5-8	1	5-32 x 5-64	4.25	6.70
14	2 1-2	2 1-2	1	5-32 x 5-64	3.75	6.00
16	2 1-2	2 1-2	1	5-32 x 5-64	3.50	5.65
18	2 3-8	2 3-8	1	5-32 x 5-64	3.35	5.35
20	2 3-8	2 3-8	1	5-32 x 5-64	3.25	5.00
22	2 1-4	2 1-4	1	5-32 x 5-64	3.10	4.80
24	2 1-4	2 1-4	1	5-32 x 5-64	3.00	4.70

### FOR USE ON NOS. 3H AND 4 AUTOMATIC GEAR CUTTING MACHINES

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
3	4 3-8	4 3-4	1 1-4	3-16 x 3-32	\$10.10	\$22.50
4	3 7-8	4 1-4	1 1-4	3-16 x 3-32	7.60	15.35
5	3 5-8	3 3-4	1 1-4	3-16 x 3-32	6.90	12.50
6	3 1-2	3 1-2	1 1-4	3-16 x 3-32	6.00	10.50
7	3 3-8	3 3-8	1 1-4	3-16 x 3-32	5.90	10.00
8	3 1-4	3 1-4	1 1-4	3-16 x 3-32	5.60	9.40
9	3 1-8	3 1-8	1 1-4	3-16 x 3-32	5.35	8.75
10	3	3	1 1-4	3-16 x 3-32	5.00	8.10
11	2 7-8	2 7-8	1 1-4	3-16 x 3-32	4.80	7.80
12	2 7-8	2 7-8	1 1-4	3-16 x 3-32	4.60	7.40

List of Keyways, page 281.

## Involute Gear Cutters

Cutters for pitches not given in the list below will be made to order. Eight cutters made for each pitch, see page 292. 3 pitch and coarser in Cast Iron and 4 pitch and coarser in Steel require 2 cuts to insure accuracy.

### FOR USE ON NO. 5 AUTOMATIC GEAR CUTTING MACHINES

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
2	5 3-4	5 3-4	1 1-2	5-16 x 5-32	\$20.25	\$43.75
2 1-2	5 1-2	5 3-4	1 1-2	5-16 x 5-32	13.90	33.15
3	5	5 1-4	1 1-2	5-16 x 5-32	11.40	25.40
4	4 1-4	4 1-2	1 1-2	5-16 x 5-32	7.90	16.90
5	4	4 1-4	1 1-2	5-16 x 5-32	7.00	14.10
6	3 3-4	3 7-8	1 1-2	5-16 x 5-32	6.70	12.20
7	3 5-8	3 5-8	1 1-2	5-16 x 5-32	6.50	11.65
8	3 1-2	3 1-2	1 1-2	5-16 x 5-32	5.80	9.70

### FOR USE ON NO. 6 AUTOMATIC GEAR CUTTING MACHINES

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
1 3-4	6 1-2	6 1-2	1 3-4	3-8 x 3-16	\$30.35	\$63.75
2	6 1-2	6 1-2	1 3-4	3-8 x 3-16	21.50	48.65
2 1-2	5 7-8	6 1-8	1 3-4	3-8 x 3-16	14.60	36.50
3	5 3-8	5 5-8	1 3-4	3-8 x 3-16	12.00	29.40
4	4 5-8	4 3-4	1 3-4	3-8 x 3-16	8.65	18.15
5	4 3-8	4 3-8	1 3-4	3-8 x 3-16	7.60	15.00
6	4 1-4	4 1-4	1 3-4	3-8 x 3-16	7.30	13.40

List of Keyways, page 281.

## Cutters for Mitre and Bevel Gears

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
3	4	4	1 1-4	<b>\$9.50</b>	<b>\$17.90</b>
4	3 1-2	3 5-8	1 1-4	<b>7.00</b>	<b>13.65</b>
5	3 1-4	3 3-8	1 1-4	<b>6.00</b>	<b>11.15</b>
6	3	3 1-8	1	<b>5.50</b>	<b>10.00</b>
7	2 7-8	2 7-8	1	<b>5.15</b>	<b>8.75</b>
8	2 7-8	2 7-8	1	<b>5.00</b>	<b>8.50</b>
10	2 1-4	2 3-8	7-8	<b>4.50</b>	<b>7.10</b>
12	2 1-8	2 1-4	7-8	<b>3.90</b>	<b>6.00</b>
14	2	2 1-8	7-8	<b>3.40</b>	<b>5.65</b>
16	2	2 1-8	7-8	<b>3.20</b>	<b>5.25</b>
20	1 7-8	2	7-8	<b>2.90</b>	<b>4.60</b>
24	1 3-4	1 3-4	7-8	<b>2.65</b>	<b>4.25</b>

List of Keyways, page 281.

Cutters for pitches not given in the above list will be made to order.

These cutters are thin enough to cut any bevel gear whose tooth face is not longer than one-third the distance from its outer end to the point where the shaft center-lines meet. This makes the tooth thickness at the inner end not less than two-thirds that at the outer end.

In ordering cutters for bevel gears, if the number of teeth in each gear, the pitch and length of face are given, also the angle of the shafts, if different from a right angle, we can select the proper cutter to send.

Eight cutters are made for each pitch and are numbered from 1 to 8.

As the number of teeth in the bevel gears to be cut with each cutter will not always agree with the list on page 292 the number of cutter must be found for each pair of gears to be cut according to the diagram or formula on page 302.

See pages 297 to 302 for directions and tables for selecting bevel gear cutters.



## Cutters for Mitre and Bevel Gears

Cutters for pitches not given in the list below will be made to order. Eight cutters made for each pitch, page 292. 3 pitch and coarser in Cast Iron, and 4 pitch and coarser in Steel require 2 cuts to insure accuracy.

See pages 297 to 302 for directions and tables for selecting bevel gear cutters.

### FOR USE ON NO. 13 AUTOMATIC GEAR CUTTING MACHINES

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
4	3 3-8	3 1-2	7-8	1-8 x 1-16	\$7.00	\$12.50
5	3 1-8	3 1-4	7-8	1-8 x 1-16	6.00	10.30
6	3	3 1-8	7-8	1-8 x 1-16	5.50	10.00
7	2 3-4	2 7-8	7-8	1-8 x 1-16	5.15	8.75
8	2 3-4	2 7-8	7-8	1-8 x 1-16	5.00	8.50
10	2 5-8	2 5-8	7-8	1-8 x 1-16	4.60	7.30
12	2 1-2	2 1-2	7-8	1-8 x 1-16	4.00	6.25

List of Keyways, page 281.

## Table for Selecting Cutters for Bevel Gears with Axes at Right Angles Only

### SELECTION OF CUTTERS

The following tables are for use in selecting cutters for cutting bevel gears. The various numbers of teeth in gear and pinion are given, and at the intersection of the two columns will be found the numbers of the cutters required.

*Example.*—Required cutters for a pair of bevel gears, 8 pitch; gear 24 teeth, pinion 12 teeth.

In column at left of table, page 298, will be found 24 teeth, and in column at top 12 teeth; at the intersection of these two columns will be found the numbers of the cutters, in this case No. 3 for the gear and No. 8 for the pinion.

Number of cutter for gear is given first.

# Cutters for Use in Cutting Bevel Gears

## PINION

GEAR

	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
12	7-7																		
13	6-7	6-6																	
14	5-7	6-6	6-6																
15	5-7	5-6	5-6	5-5															
16	4-7	5-7	5-6	5-6	5-5														
17	4-7	4-7	4-6	5-6	5-5	5-5													
18	4-7	4-7	4-6	4-6	4-5	4-5	5-5												
19	3-7	4-7	4-6	4-6	4-6	4-5	4-5	4-4											
20	3-7	3-7	4-6	4-6	4-6	4-5	4-5	4-4	4-4										
21	3-8	3-7	3-7	3-6	4-6	4-5	4-5	4-5	4-4	4-4									
22	3-8	3-7	3-7	3-6	3-6	3-5	4-5	4-5	4-4	4-4	4-4								
23	3-8	3-7	3-7	3-6	3-6	3-5	3-5	3-5	3-4	4-4	4-4	4-4							
24	3-8	3-7	3-7	3-6	3-6	3-6	3-5	3-5	3-4	3-4	3-4	4-4	4-4						
25	2-8	2-7	3-7	3-6	3-6	3-6	3-5	3-5	3-5	3-4	3-4	3-4	4-4	3-3					
26	2-8	2-7	3-7	3-6	3-6	3-6	3-5	3-5	3-5	3-4	3-4	3-4	3-4	3-3	3-3				
27	2-8	2-7	2-7	2-6	3-6	3-6	3-5	3-5	3-5	3-4	3-4	3-4	3-4	3-3	3-3				
28	2-8	2-7	2-7	2-6	2-6	3-6	3-5	3-5	3-5	3-4	3-4	3-4	3-4	3-3	3-3	3-3			
29	2-8	2-7	2-7	2-7	2-6	2-6	3-5	3-5	3-5	3-4	3-4	3-4	3-4	3-3	3-3	3-3	3-3		
30	2-8	2-7	2-7	2-7	2-6	2-6	2-5	2-5	3-5	3-5	3-4	3-4	3-4	3-4	3-3	3-3	3-3	3-3	
31	2-8	2-7	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	3-4	3-4	3-4	3-4	3-3	3-3	3-3	3-3	3-3
32	2-8	2-7	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	3-4	3-4	3-4	3-3	3-3	3-3	3-3
33	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	3-4	3-4	3-4	3-3	3-3	3-3
34	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	3-4	3-3	3-3	3-3
35	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3	3-3	3-3
36	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3	2-3
37	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3	2-3
38	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3	2-3
39	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3	2-3
40	1-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3	2-3
41	1-8	1-8	2-7	2-7	2-6	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3	2-3
42	1-8	1-8	2-7	2-7	2-6	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3	2-3
43	1-8	1-8	1-7	2-7	2-6	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-3	2-3	2-3
44	1-8	1-8	1-7	1-7	2-6	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
45	1-8	1-8	1-7	1-7	1-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
46	1-8	1-8	1-7	1-7	1-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
47	1-8	1-8	1-7	1-7	1-7	1-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
48	1-8	1-8	1-7	1-7	1-7	1-6	1-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
49	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
50	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
51	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
52	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	1-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
53	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	1-5	1-5	2-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
54	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	1-5	1-5	1-5	2-4	2-4	2-4	2-4	2-4	2-3	2-3
55	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	1-5	1-5	1-5	1-4	2-4	2-4	2-4	2-4	2-3	2-3



Cutters for Use in Cutting  
Bevel Gears

(Continued)

PINION

GEAR	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
31	3-3																			
32	3-3	3-3																		
33	3-3	3-3	3-3																	
34	3-3	3-3	3-3	3-3																
35	3-3	3-3	3-3	3-3	3-3															
36	2-3	3-3	3-3	3-3	3-3	3-3														
37	2-3	2-3	2-3	2-3	3-3	3-3	3-3													
38	2-3	2-3	2-3	2-3	2-3	3-3	3-3	3-3												
39	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2										
40	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2									
41	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2									
42	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2							
43	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2						
44	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2					
45	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2				
46	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2			
47	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2		
48	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	
49	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
50	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
51	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
52	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
53	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
54	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
55	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2



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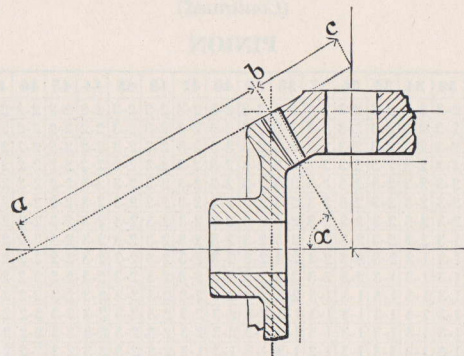
# GEAR

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## Formula for Determining the Number of Cutter for Bevel Gear and Pinion



$N_a$  = No. of Teeth in Gear

$N_b$  = No. of Teeth in Pinion

$a$  = Center Angle of Gear

Measure the back cone radius  $a b$  for the gear, or  $b c$  for the pinion. This is equal to the radius of a spur gear, the number of teeth in which would determine the cutter to use. Hence twice  $a b$  times the diametral pitch equals the number of teeth for which the cutter should be selected for the gear. Looking in the list on page 292, the proper number for the cutter can be found.

Thus let the back cone radius  $a b$  be 4" and the diametral pitch be 8. Twice 4 is 8, and  $8 \times 8$  is 64, from which it can be seen that the cutter must be of shape No. 2, as 64 is between 55 and 134, the range covered by No. 2 cutter.

The number of teeth for which the cutter should be selected can also be found by the following formula:

$$\tan a = \frac{N_a}{N_b}$$

$$\text{No. of teeth to select cutter for gear} = \frac{N_a}{\cos a}$$

$$\text{No. of teeth to select cutter for pinion} = \frac{N_b}{\sin a}$$

If the gears are mitres or are alike, only one cutter is needed; if one gear is larger than the other, two may be needed.

Additional helps on this subject can be found in our publications "Practical Treatise on Gearing" and "Formulas in Gearing."



# Involute Gear Cutters

For Gears of Large Diameter

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
1	8 1-2	8 1-2	1 1-2 or 2	\$57.00	\$135.65
1 1-4	7 3-4	7 3-4	1 1-2 or 2	48.00	116.65
1 1-2	7 1-4	7 1-4	1 1-2 or 2	41.75	91.90
1 3-4	6 3-4	6 3-4	1 1-2 or 2	31.65	70.00
2	6 1-4	6 1-4	1 1-2 or 2	21.50	48.65
2 1-4	6 1-4	6 1-4	1 1-2 or 2	17.10	40.60
2 1-2	6 1-4	6 1-4	1 1-2 or 2	15.20	36.50
2 3-4	5 3-4	6 1-4	1 1-2 or 2	13.75	34.65
3	5 1-4	5 1-4	1 1-2 or 2	12.00	25.40
4	5 1-4	5 1-4	1 1-2 or 2	10.00	20.75
5	5 1-4	5 1-4	1 1-2 or 2	8.75	19.10
6	4 1-4	4 1-4	1 1-2 or 2	7.30	13.40
7	4 1-4	4 1-4	1 1-2 or 2	7.10	12.50
8	4 1-4	4 1-4	1 1-2 or 2	6.80	12.20
10	4 1-4	4 1-4	1 1-2 or 2	6.60	11.50
12	4 1-4	4 1-4	1 1-2 or 2	6.00	10.90
14	4 1-4	4 1-4	1 1-2 or 2	5.00	9.40
16	4 1-4	4 1-4	1 1-2 or 2	5.00	9.40

For the above Cutters with 1 1-2" hole the Keyways are 3-8" wide and 3-16" deep; with 2" hole the Keyways are 1-2" wide and 3-16" deep.

Cutters for pitches not given in the above list made to order.

List of Keyways, page 281.

## Formulas for Determining the Dimensions of Gears by Metric Pitch

Module is the pitch diameter in millimetres divided by the number of teeth in the gear.

Pitch diameter in millimetres is the Module multiplied by the number of teeth in the gear.

$$M = \frac{D'}{N} \text{ or } \frac{D}{N+2} = \text{Module}$$

$$D' = N M = \text{The pitch diameter of gear in millimetres}$$

$$D = (N + 2) M = \text{The whole diameter of gear in millimetres}$$

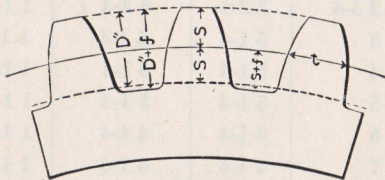
$$N = \frac{D'}{M} \text{ or } \frac{D}{M} - 2 = \text{The number of teeth in gear}$$

$$D'' = 2 M = \text{The working depth of teeth}$$

$$t = M 1.5708 = \text{Thickness of teeth on pitch line}$$

$$f = \frac{M 1.5708}{10} = .157 M = \text{Amount added to depth for clearance}$$

The Module is equal to the part marked "S" in cut opposite, measured in millimetres and parts of millimetres.



## Pitches Commonly Used Module in Millimetres

Module, m/m	Corresponding English Diametral Pitch	Module, m/m	Corresponding English Diametral Pitch	Module, m/m	Corresponding English Diametral Pitch
0.5	50.800	2.75	9.236	8	3.175
0.75	33.867	3	8.466	9	2.822
1	25.400	3.5	7.257	10	2.540
1.25	20.320	4	6.350	11	2.309
1.5	16.933	4.5	5.644	12	2.117
1.75	14.514	5	5.080	13	1.954
2	12.700	5.5	4.618	14	1.814
2.25	11.288	6	4.233	15	1.693
2.5	10.160	7	3.628	16	1.587

## Metric Involute Gear Cutters

We are prepared to furnish, at short notice, cutters for cutting the teeth of Gears according to the Metric system.

Module is the Pitch Diameter in millimetres divided by the number of teeth in the gear.

Pitch Diameter in millimetres is the Module multiplied by the number of teeth in the gear.

M = Module

D' = Pitch Diameter in m/m

N = No. of Teeth in Gear

D' = M × N

For example: M = 3.50 m/m; N = 100; D' = 3.50 × 100 = 350 m/m. Further explanation, page 304.

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
1-2	1 3-4	1 3-4	7-8" or 22 m/m	\$3.25	\$4.75
3-4	1 3-4	1 3-4	7-8 or 22	3.25	4.75
1	1 3-4	1 3-4	7-8 or 22	3.65	5.25
1 1-4	1 7-8	2	7-8 or 22	3.90	5.60
1 1-2	2	2 1-8	7-8 or 22	4.20	6.25
1 3-4	2	2 1-8	7-8 or 22	4.40	6.65
2	2 1-8	2 1-4	7-8 or 22	4.90	7.00
2 1-4	2 1-4	2 3-8	7-8 or 22	5.20	7.65
2 1-2	2 1-4	2 3-8	7-8 or 22	5.50	8.10
2 3-4	2 3-4	2 3-4	1 or 27	5.70	8.65
3	2 7-8	2 7-8	1 or 27	6.00	9.50
3 1-4	2 7-8	2 7-8	1 or 27	6.15	9.75
3 1-2	2 7-8	2 7-8	1 or 27	6.15	9.75
3 3-4	2 7-8	2 7-8	1 or 27	6.50	10.15
4	3	3 1-8	1 or 27	6.50	11.00
4 1-4	3	3 1-8	1 or 27	7.00	11.30
4 1-2	3 5-8	3 3-4	1 1-4 or 32	7.90	13.50
4 3-4	3 5-8	3 3-4	1 1-4 or 32	7.90	13.50
5	3 5-8	3 3-4	1 1-4 or 32	7.90	13.50
5 1-4	3 5-8	3 3-4	1 1-4 or 32	8.30	14.65
5 1-2	3 3-4	4	1 1-4 or 32	8.30	15.40
5 3-4	3 3-4	4	1 1-4 or 32	8.30	15.40
6	3 7-8	4 1-4	1 1-4 or 32	8.60	16.35
7	4 1-8	4 1-2	1 1-4 or 32	10.50	21.00
8	4 3-8	4 3-4	1 1-4 or 32	11.10	23.50
9	5 1-8	5 1-2	1 1-2 or 40	13.75	28.50
10	5 1-2	5 3-4	1 1-2 or 40	14.90	34.15
11	5 3-4	5 3-4	1 1-2 or 40	17.00	37.00
12	5 3-4	5 3-4	1 1-2 or 40	21.25	44.75

Cutters for pitches not given in the above list made to order.

Eight cutters made for each pitch, page 292. List of Keyways, page 281.



# Metric Involute Gear Cutters

FOR USE ON  
NO. 3 AUTOMATIC GEAR CUTTING MACHINES

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
3-4	2 1-4	2 1-4	1" or 27 m/m	\$4.00	\$5.70
1	2 1-4	2 1-4	1 or 27	4.00	5.70
1 1-4	2 3-8	2 3-8	1 or 27	4.25	6.00
1 1-2	2 1-2	2 1-2	1 or 27	4.50	6.65
1 3-4	2 1-2	2 1-2	1 or 27	4.75	7.00
2	2 5-8	2 5-8	1 or 27	5.25	7.70
2 1-4	2 5-8	2 5-8	1 or 27	5.50	8.10
2 1-2	2 3-4	2 3-4	1 or 27	5.60	8.30
3	2 7-8	2 7-8	1 or 27	6.00	9.50
3 1-2	2 7-8	2 7-8	1 or 27	6.15	9.75
4	3	3 1-8	1 or 27	6.50	11.00
4 1-2	3 1-8	3 1-4	1 or 27	6.80	11.00
5	3 1-4	3 3-8	1 or 27	7.00	12.15
5 1-2	3 3-8	3 1-2	1 or 27	8.00	13.50
6	3 1-2	3 5-8	1 or 27	8.00	14.65

FOR USE ON  
NOS. 3H & 4 AUTOMATIC GEAR CUTTING MACHINES

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
1 1-4	2 3-4	2 3-4	1 1-4" or 32 m/m	\$4.50	\$6.25
1 1-2	2 7-8	2 7-8	1 1-4 or 32	4.90	7.50
1 3-4	2 7-8	2 7-8	1 1-4 or 32	5.00	7.65
2	2 7-8	2 7-8	1 1-4 or 32	5.60	8.40
2 1-4	2 7-8	2 7-8	1 1-4 or 32	5.80	8.80
2 1-2	3	3	1 1-4 or 32	6.00	9.10
3	3 1-4	3 1-4	1 1-4 or 32	6.60	10.40
3 1-2	3 3-8	3 3-8	1 1-4 or 32	6.90	11.00
4	3 1-2	3 1-2	1 1-4 or 32	7.00	11.50
4 1-2	3 5-8	3 3-4	1 1-4 or 32	7.90	13.50
5	3 5-8	3 3-4	1 1-4 or 32	7.90	13.50
5 1-2	3 3-4	4	1 1-4 or 32	8.30	15.40
6	3 7-8	4 1-4	1 1-4 or 32	8.60	16.35
7	4 1-8	4 1-2	1 1-4 or 32	10.50	21.00
8	4 3-8	4 3-4	1 1-4 or 32	11.10	23.50

Cutters for pitches not given in the above list made to order.  
Eight cutters made for each pitch. See page 292.  
List of Keyways, page 281.

# Metric Involute Gear Cutters

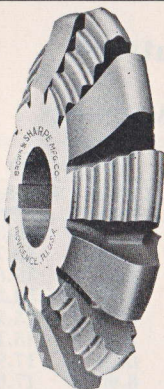
FOR USE ON  
NO. 5 AUTOMATIC GEAR CUTTING MACHINES

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
2 1-2	3 1-2	3 1-2	1 1-2" or 40 m/m	\$6.60	\$10.35
3	3 1-2	3 1-2	1 1-2 or 40	6.80	10.70
3 1-2	3 5-8	3 5-8	1 1-2 or 40	7.50	12.65
4	3 3-4	3 7-8	1 1-2 or 40	7.70	13.20
4 1-2	3 7-8	4 1-8	1 1-2 or 40	8.00	15.10
5	4	4 1-4	1 1-2 or 40	8.00	15.10
5 1-2	4 1-8	4 3-8	1 1-2 or 40	8.90	17.90
6	4 1-4	4 1-2	1 1-2 or 40	8.90	17.90
7	4 5-8	4 7-8	1 1-2 or 40	11.75	24.15
8	5	5 1-4	1 1-2 or 40	12.40	26.40
9	5 1-8	5 1-2	1 1-2 or 40	13.75	28.50
10	5 1-2	5 3-4	1 1-2 or 40	14.90	34.15
11	5 3-4	5 3-4	1 1-2 or 40	17.00	37.00
12	5 3-4	5 3-4	1 1-2 or 40	21.25	44.75

FOR USE ON  
NO. 6 AUTOMATIC GEAR CUTTING MACHINES

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
3	4	4	1 3-4" or 45 m/m	\$7.40	\$12.25
3 1-2	4 1-8	4 1-8	1 3-4 or 45	8.10	13.50
4	4 1-4	4 1-4	1 3-4 or 45	8.30	14.40
4 1-2	4 3-8	4 3-8	1 3-4 or 45	8.60	16.00
5	4 3-8	4 3-8	1 3-4 or 45	8.60	16.00
5 1-2	4 1-2	4 5-8	1 3-4 or 45	9.25	19.15
6	4 5-8	4 3-4	1 3-4 or 45	9.65	19.15
7	5	5 1-4	1 3-4 or 45	12.40	26.40
8	5 3-8	5 5-8	1 3-4 or 45	13.00	30.40
9	5 5-8	5 7-8	1 3-4 or 45	14.75	32.25
10	5 7-8	6 1-8	1 3-4 or 45	15.60	37.50
11	6 1-4	6 1-2	1 3-4 or 45	18.10	41.60
12	6 1-2	6 1-2	1 3-4 or 45	22.50	49.65

Cutters for pitches not given in the above list made to order.  
Eight cutters made for each pitch, see page 292.  
List of Keyways, page 281.



## Improved Stocking Cutters

### For Involute Gears

By the use of these cutters, heavy cuts at fast speeds and coarse feeds can be taken because of the easier cutting action produced.

The greater part of the cutting is performed by the plain teeth, the stepped teeth projecting beyond the outline of the plain teeth only enough to break up the chips.

Because of the smooth and easy cutting action a minimum amount of power is consumed in driving the machine.

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Price, Each	
	Carbon Steel	High-Speed Steel		Carbon Steel	High-Speed Steel
*1	8 1-2	8 1-2	2	\$57.00	\$135.65
*1 1-4	7 3-4	7 3-4	2	48.00	116.65
*1 1-2	7	7	1 3-4	40.50	86.90
1 3-4	6 1-2	6 1-2	1 3-4	30.35	63.75
2	5 3-4	5 3-4	1 1-2	20.25	43.75
2 1-2	5 1-2	5 3-4	1 1-2	13.90	33.15
3	4 3-8	4 3-4	1 1-4	10.10	22.50
4	3 7-8	4 1-4	1 1-4	7.60	15.35
5	3 5-8	3 3-4	1 1-4	6.90	12.50
6	3	3 1-8	1	5.50	10.00
7	2 7-8	2 7-8	1	5.15	8.75
8	2 7-8	2 7-8	1	5.00	8.50

\* Made to order.

### FOR USE ON NO. 3 AUTOMATIC GEAR CUTTING MACHINES

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
4	3 1 2	3 5 8	1	5-32 x 5-64	\$7.00	\$13.65
5	3 1-4	3 3-8	1	5-32 x 5-64	6.00	11.15
6	3	3 1-8	1	5-32 x 5-64	5.50	10.00
7	2 7-8	2 7-8	1	5-32 x 5-64	5.15	8.75
8	2 7-8	2 7-8	1	5-32 x 5-64	5.00	8.50

Cutters for pitches not given in the above list made to order.

List continued on next page.

List of Keyways, page 281.



## Improved Stocking Cutters

**FOR USE ON NOS. 3 HEAVY AND 4 AUTOMATIC GEAR CUTTING MACHINES**

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
3	4 3-8	4 3-4	1 1-4	3-16 x 3-32	\$10.10	\$22.50
4	3 7-8	4 1-4	1 1-4	3-16 x 3-32	7.60	15.35
5	3 5-8	3 3-4	1 1-4	3-16 x 3-32	6.90	12.50
6	3 1-2	3 1-2	1 1-4	3-16 x 3-32	6.00	10.50
7	3 3-8	3 3-8	1 1-4	3-16 x 3-32	5.90	10.00
8	3 1-4	3 1-4	1 1-4	3-16 x 3-32	5.60	9.40

**FOR USE ON NO. 5 AUTOMATIC GEAR CUTTING MACHINES**

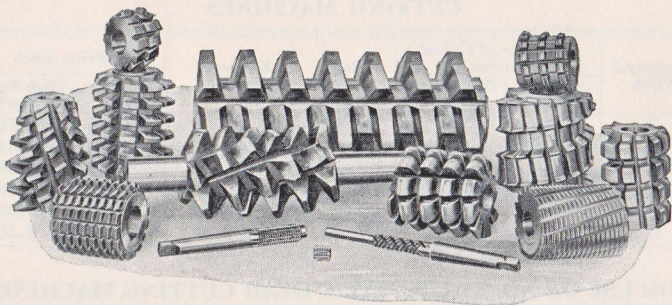
Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
2	5 3-4	5 3-4	1 1-2	5-16 x 5-32	\$20.25	\$43.75
2 1-2	5 1-2	5 3-4	1 1-2	5-16 x 5-32	13.90	33.15
3	5	5 1-4	1 1-2	5-16 x 5-32	11.40	25.40
4	4 1-4	4 1-2	1 1-2	5-16 x 5-32	7.90	16.90
5	4	4 1-4	1 1-2	5-16 x 5-32	7.00	14.10
6	3 3-4	3 7-8	1 1-2	5-16 x 5-32	6.70	12.20
7	3 5-8	3 5-8	1 1-2	5-16 x 5-32	6.50	11.65
8	3 1-2	3 1-2	1 1-2	5-16 x 5-32	5.80	9.70

**FOR USE ON NO. 6 AUTOMATIC GEAR CUTTING MACHINES**

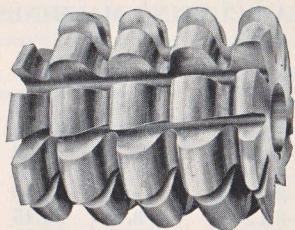
Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Price, Each	
	Carbon Steel	High-Speed Steel			Carbon Steel	High-Speed Steel
1 3-4	6 1-2	6 1-2	1 3-4	3-8 x 3-16	\$30.35	\$63.75
2	6 1-2	6 1-2	1 3-4	3-8 x 3-16	21.50	48.65
2 1-2	5 7-8	6 1-8	1 3-4	3-8 x 3-16	14.60	36.50
3	5 3-8	5 5-8	1 3-4	3-8 x 3-16	12.00	29.40
4	4 5-8	4 3-4	1 3-4	3-8 x 3-16	8.65	18.15
5	4 3-8	4 3-8	1 3-4	3-8 x 3-16	7.60	15.00
6	4 1-4	4 1-4	1 3-4	3-8 x 3-16	7.30	13.40

Cutters for pitches not given in the above lists made to order.  
List of Keyways, page 281.

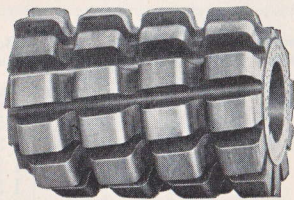
## Hobs



Due to our method of relieving the teeth, Brown & Sharpe Hobs cut as freely as milling cutters and are sharpened in the same manner as our formed cutters. The selection and treatment of the steel used in their manufacture are subjects of intensive study and careful investigation. Special machinery enables us to produce hobs for hobbing spur, spiral or helical gears, sprockets and splined shafts as well as hobs for special purposes at short notice.

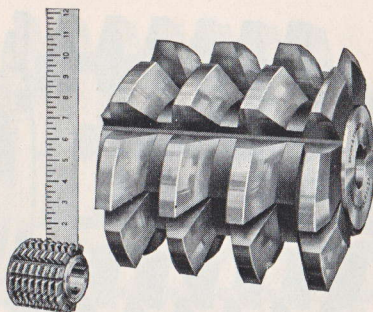


**Roller Chain Sprocket Hob**



**Block Chain Sprocket Hob**

## Ground Hobs



While unground hobs may fill the needs of ordinary practice, we recommend Ground Hobs for best results.

Not only will the gears hobbled with Ground Hobs run more quietly, but the hob can be used from one end to the other without attention other than shifting it endwise. This is not always permissible with the unground hob, owing to slight distortion in hardening which may appear at any point in the unground hob, thus limiting its use.

In grinding the teeth of hobs, not only is the lead corrected, but the cutting edges are made keen with a positive clearance from the cutting edge, which eliminates the danger of rubbing on the sides of the teeth.

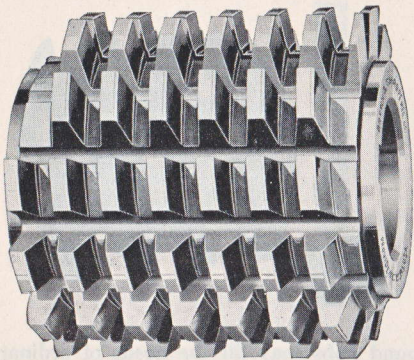
Due to this uniformity and keenness, it has frequently been demonstrated that the production per sharpening is greatly increased. Therefore, it is often advisable to use Ground Hobs for roughing operations.

We make it a point to carefully test each hob on a special Hob Testing Machine after grinding.

All our ground hobs are made with short hubs, which are ground true with the hole and the teeth, and serve as points for indicator when testing hobs for true running after mounting and clamping to the hob spindle.



Spur Gear Hobs



The Spur Gear Hobs in the following lists are furnished at the prices stated—unground, right- or left-hand, with 14 1-2° pressure angle, and single threaded. In ordering hobs with specifications other than those listed, the following data should be given:

- Pitch of gear to be cut
- Size of hole and keyway
- Whether right- or left-hand
- Whether hob should be of carbon or high-speed steel
- Diameter and length of hob
- Whether single or multiple thread
- Whether ground or unground

Unless otherwise specified, Spur Gear Hobs are made with 14 1-2° pressure angle and single threaded.

Pitch	Outside Diameter, Inches	Length, Inches	Size of Hole, Inches	Size of Keyway, Inches	Price Each, High-Speed Steel
1	10 3-4	15	2 1-2	5-8 x 5-16	On Application
1 1-4	8 3-4	12	2	1-2 x 1-4	\$476.90
1 1-2	8	10	2	1-2 x 1-4	333.75
1 3-4	7 1-4	9	2	1-2 x 1-4	273.70
2	5 3-4	8	1 1-2	3-8 x 3-16	168.65
2 1-4	5 1-4	7 1-2	1 1-2	3-8 x 3-16	140.50
2 1-2	5	7	1 1-2	3-8 x 3-16	123.20
2 3-4	4 3-4	6	1 1-2	3-8 x 3-16	99.10

Prices of Ground Hobs on application.  
Hobs for pitches not given in the above list made to order.

**Spur Gear Hobs** *(Continued)***1 1-4 Inch Hole**

Pitch	Outside Diameter, Inches	Length Inches	Size of Hole, Inches	Size of Keyway, Inches	Price, Each, High-Speed Steel
3	4 1-2	5	1 1-4	1-4 x 1-8	\$77.35
3 1-2	4 1-4	4 3-4	1 1-4	1-4 x 1-8	68.60
4	4	4	1 1-4	1-4 x 1-8	53.80
5	3 1-2	3 1-2	1 1-4	1-4 x 1-8	40.60
6	3 1-4	3 1-4	1 1-4	1-4 x 1-8	34.80
7	3	3	1 1-4	1-4 x 1-8	29.50
8	3	3	1 1-4	1-4 x 1-8	29.50
9	3	3	1 1-4	1-4 x 1-8	29.50
10	2 3-4	2 3-4	1 1-4	1-4 x 1-8	27.70
12	2 3-4	2 3-4	1 1-4	1-4 x 1-8	29.10
14	2 1-2	2 1-2	1 1-4	1-4 x 1-8	27.00
16	2 1-2	2 1-2	1 1-4	1-4 x 1-8	27.00
18	2 1-2	2 1-2	1 1-4	1-4 x 1-8	28.30
20	2 1-2	2 1-2	1 1-4	1-4 x 1-8	28.30
22	2 1-2	2	1 1-4	1-4 x 1-8	26.00
24	2 1-2	2	1 1-4	1-4 x 1-8	27.15
26	2 1-2	2	1 1-4	1-4 x 1-8	27.15
28	2 1-2	2	1 1-4	1-4 x 1-8	27.15
30	2 1-2	2	1 1-4	1-4 x 1-8	29.50

**3-4 Inch Hole**

12	2	2	3-4	1-8 x 1-16	\$22.50
14	1 7-8	1 7-8	3-4	1 8 x 1 16	21.25
16	1 7-8	1 7-8	3-4	1-8 x 1-16	21.25
18	1 7-8	1 7-8	3-4	1-8 x 1-16	22.30
20	1 7-8	1 7-8	3-4	1-8 x 1-16	22.30
22	1 7-8	1 7-8	3-4	1-8 x 1-16	22.30
24	1 7-8	1 7-8	3-4	1-8 x 1-16	23.30
26	1 7-8	1 7-8	3-4	1-8 x 1-16	23.30
28	1 7-8	1 7-8	3-4	1-8 x 1-16	23.30
30	1 7-8	1 1-2	3-4	1-8 x 1-16	23.15
32	1 7-8	1 1-2	3-4	1-8 x 1-16	23.15
34	1 7-8	1 1-2	3-4	1-8 x 1-16	24.10
36	1 7-8	1 1-2	3-4	1-8 x 1-16	24.10
38	1 7-8	1 1-2	3-4	1-8 x 1-16	24.10
40	1 7-8	1 1-2	3-4	1-8 x 1-16	25.90
42	1 7-8	1 1-2	3-4	1-8 x 1-16	25.90
44	1 7-8	1 1-2	3-4	1-8 x 1-16	25.90
46	1 7-8	1 1-2	3-4	1-8 x 1-16	27.75
48	1 7-8	1 1-2	3-4	1-8 x 1-16	27.75
50	1 7-8	1 1-2	3-4	1-8 x 1-16	27.75

Prices of Ground Hobs on application.

Hobs for pitches not given in the above list made to order.

## Spur Gear Hobs (Continued)

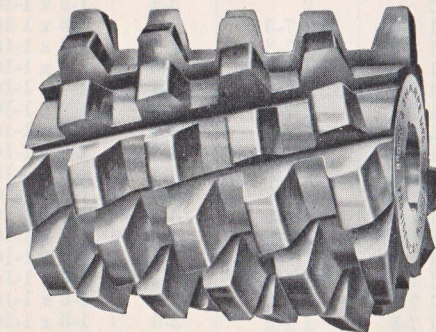
1-2 Inch Hole

Pitch	Outside Diameter, Inches	Length, Inches	Size of Hole, Inches	Size of Keyway, Inches	Price Each, High-Speed Steel
24	1 1-4	1 1-4	1-2	1-8 x 1-16	<b>\$16.25</b>
26	1 1-4	1 1-4	1-2	1-8 x 1-16	<b>16.25</b>
28	1 1-4	1 1-4	1-2	1-8 x 1-16	<b>16.25</b>
30	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>16.10</b>
32	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>16.10</b>
34	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>16.70</b>
36	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>16.70</b>
38	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>16.70</b>
40	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>18.00</b>
42	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>18.00</b>
44	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>18.00</b>
46	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>19.30</b>
48	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>19.30</b>
50	1 1-8	1 1-8	1-2	1-8 x 1-16	<b>19.30</b>

Prices of Ground Hobs on Application.

Hobs for pitches not given in the above list made to order.

## Worm Gear Hobs



We usually make the outside diameter of Worm Gear Hobs larger than that of the worms by an amount equal to two standard clearances for the pitch in question. To this is also added a sharpening allowance so that the hob will give a reasonable amount of service without having its pitch diameter reduced to less than that of the worm.



## Worm Gear Hobs

*(Continued)*

Many worms are cut with double angle milling cutters, but it will be found that the shape of the space produced will not be the same as the shape of the cutter. This difference in shape is slight, in the case of the ordinary single thread worm, but may become very considerable in the case of worms having several threads.

The diameter of the cutter used also has its effect on the shape produced and should therefore be specified.

Ordering Worm Gear Hobs:—

In ordering Worm Gear Hobs the following data should be given:

Outside diameter and length of worm. Lead. Axial pitch. Number of threads: right or left hand. Dimensions of hole and keyway. Whether hob is to be of high-speed or carbon steel. Teeth ground or formed. If hob must be made with a taper shank, indicate direction in which hob rotates with respect to the shank end. Give number of teeth in gear. If the gear is to be rotated by the hob while cutting, this fact should be indicated so that a proper amount of cutting clearance can be provided.

Hobs whose threads make an angle of 72 degrees or more with the axis can be made with straight grooves. Such hobs are simple to sharpen and can usually be produced more cheaply if only a single hob is required. If the hob is to be used extensively, or if the best possible job is wanted, it may be advisable to use spiral grooves, even though the angle of thread with the axis is considerably larger than 72 degrees. When made with spiral grooves at right angles to the thread, the cutting action is the same at each cutting edge, while if straight grooves are used one edge becomes an acute angle, while the other is made somewhat obtuse.

If the nature of the work requires a hob of exact diameter, it should be plainly stated, otherwise the sharpening allowance mentioned above will be added.

## The Sizing and Cutting of Gears

**Diameter**, when applied to gears, is always understood to mean the pitch diameter.

**Diametral Pitch** is the number of teeth to each inch of the pitch diameter.

*Example.* If a gear has 40 teeth and the pitch diameter is 4 inches, there are 10 teeth to each inch of the pitch diameter and the diametral pitch is 10, or, in other words, the gear is 10 diametral pitch.

**Diametral Pitch** required, circular pitch given. Divide 3.1416 by the circular pitch.

*Example.* If the circular pitch is 2 inches, divide 3.1416 by 2, and the quotient, 1.5708, is the diametral pitch.

**Diametral Pitch** required, number of teeth and outside diameter given. Add 2 to the number of teeth and divide by the outside diameter.

*Example.* If the number of teeth is 40, the diameter of the blank is  $10\frac{1}{2}$  inches; add 2 to the number of teeth, making 42, and divide by  $10\frac{1}{2}$ ; the quotient, 4, is the diametral pitch.

**Circular Pitch** is the distance from the center of one tooth to the center of the next, measured along the pitch line.

*Example.* If the distance from the center of one tooth to the centre of next tooth, measured along the pitch circle, is  $\frac{1}{2}$  inch, the gear is  $\frac{1}{2}$  inch circular pitch.

**Circular Pitch** required, diametral pitch given. Divide 3.1416 by the diametral pitch.

*Example.* If the diametral pitch is 4, divide 3.1416 by 4, and the quotient, .7854 inch, is the circular pitch.

**Number of Teeth** required, pitch diameter and diametral pitch given. Multiply the pitch diameter by the diametral pitch.

*Example.* If the diameter of the pitch circle is 10 inches and the diametral pitch is 4, multiply 10 by 4, and the product, 40, will be the number of teeth in the gear.

**Number of Teeth** required, outside diameter and diametral pitch given. Multiply the outside diameter by the diametral pitch and subtract 2.

*Example.* If the whole diameter is  $10\frac{1}{2}$  inches and the diametral pitch is 4, multiply  $10\frac{1}{2}$  by 4, and the product, 42, less 2, or 40, is the number of teeth.

**Pitch Diameter** required, number of teeth and diametral pitch given. Divide the number of teeth by the diametral pitch.

*Example.* If the number of teeth is 40 and the diametral pitch is 4, divide 40 by 4, and the quotient, 10, expressed in inches, is the pitch diameter.

## Sizing and Cutting of Gears (*Continued*)

**Outside Diameter** or size of gear blank required, number of teeth and diametral pitch given. Add 2 to the number of teeth and divide by the diametral pitch.

*Example.*—If the number of teeth is 40 and the diametral pitch is 4, add 2 to the 40, making 42, and divide by 4; the quotient, 10 1-2, is the whole diameter of the gear or blank.

**Thickness of Tooth at Pitch Line** required. Divide the circular pitch by 2, or 1.57 by the diametral pitch.

*Example.*—If the circular pitch is 1.047 inches, or the diametral pitch is 3, divide 1.047 by 2, or 1.57 by 3, and the quotient, .523 inch, is the thickness of tooth.

**Whole Depth of Tooth** required. Divide 2.157 by the diametral pitch.

*Example.*—If the diametral pitch of a gear is 6, the whole depth is 2.157 divided by 6, which equals .3595.

**Whole Depth of Tooth** is about 11-16 or exactly .6866 of the circular pitch.

*Example.*—If the circular pitch is 2 inches, the whole depth of tooth is  $.6866 \times 2$  inches, or 1 3-8 inches nearly.

**Distance between Centers** of two gears required. Add the number of teeth together and divide one-half the sum by the diametral pitch.

*Example.*—If two gears have 50 and 30 teeth, respectively, and are 5 pitch, add 50 and 30, making 80, divide by 2, and then divide the quotient, 40, by the diametral pitch, 5, and the result, 8 inches, is the center distance.

## Measurement of Gears

We call attention to the following tools that have been developed by us to facilitate measurements in connection with the cutting and sizing of gears:

**Vernier Caliper No. 573**, for determining accurately the depth of gear teeth. Page 128.

**Gear Tooth Verniers Nos. 580 and 581**, for accurately measuring the thickness at pitch line or the chordal thickness of gear teeth and the distance from top of tooth to the chord. Page 131.

**Depth of Gear Tooth Micrometer No. 249**, for scribing a line on gear blanks to indicate accurately the extreme depth to cut the teeth. Page 62.

**Depth of Gear Tooth Gauges No. 725.** Page 186.



### Tables Showing Corresponding Circular and Diametral Pitches

Table No. 1 shows the diametral pitches with the corresponding circular pitches.

Table No. 2 shows the circular pitches with the corresponding diametral pitches.

Table No. 1				Table No. 2			
Diam- etral Pitch	Circular Pitch, Inches	Diam- etral Pitch	Circular Pitch, Inches	Circular Pitch, Inches	Diam- etral Pitch	Circular Pitch, Inches	Diam- etral Pitch
1 1-4	2.5133	11	.286	2	1.571	3-4	4.189
1 1-2	2.0944	12	.262	1 7-8	1.676	11-16	4.570
1 3-4	1.7952	14	.224	1 3-4	1.795	5-8	5.027
2	1.571	16	.196	1 5-8	1.933	9-16	5.585
2 1-4	1.396	18	.175	1 1-2	2.094	1-2	6.283
2 1-2	1.257	20	.157	1 7-16	2.185	7-16	7.181
2 3-4	1.142	22	.143	1 3-8	2.285	3-8	8.378
3	1.047	24	.131	1 5-16	2.394	5-16	10.053
3 1-2	.898	26	.121	1 1-4	2.513	1-4	12.566
4	.785	28	.112	1 3-16	2.646	3-16	16.755
5	.628	30	.105	1 1-8	2.793	1-8	25.133
6	.524	32	.098	1 1-16	2.957	1-16	50.266
7	.449	36	.087	1	3.142	...	...
8	.393	40	.079	15-16	3.351	...	...
9	.349	48	.065	7-8	3.590	...	...
10	.314	..	...	13-16	3.867	...	...

According to the system adopted by the Brown & Sharpe Mfg. Co., any gear of one pitch will gear into any other gear or into a rack of the same pitch. Eight cutters are required for each pitch. These eight cutters are adapted to cut from a pinion of twelve teeth to a rack, and are numbered respectively, 1, 2, 3, etc. The number of teeth and the pitch for which a cutter is adapted are also marked on each.

No. 1 will cut gears from 135 teeth to a rack  
 “ 2 “ “ “ “ 55 to 134 teeth  
 “ 3 “ “ “ “ 35 “ 54 “  
 “ 4 “ “ “ “ 26 “ 34 “  
 “ 5 “ “ “ “ 21 “ 25 “  
 “ 6 “ “ “ “ 17 “ 20 “  
 “ 7 “ “ “ “ 14 “ 16 “  
 “ 8 “ “ “ “ 12 “ 13 “

If a cutter is wanted for a gear of 40 teeth of 8 pitch, then the cutter required would be No. 3 of 8 pitch, inasmuch as a No. 3 cutter will cut all gears containing from 35 to 54 teeth, inclusive. Since 40 occurs between those numbers, No. 3 is the one desired. It should be borne in mind that eight different cutters are required in order to cut all the gears of any given pitch. Directions for the use of these cutters will be found upon pages 290 and 291.

As these cutters can be ground when dull, it is important that they be kept sharp. By paying particular attention to this, cutting will be greatly facilitated, besides being done much better.

It is desirable in applying gearing of any kind, to avoid having gears or pinions with a small number of teeth. Pinions of twelve teeth will work very well, but a less number of teeth should not be used.

Few mechanics are familiar with the minutiae of gearing; and the necessity of exact sizing of gears, as to diameter, is often overlooked. Special care is required also to know that the distance of the centers of two gears running together is correct relatively to the diameters.

**Table Showing Depth of Space and Thickness of Tooth in Spur Gears, when Cut with Our Gear Cutters**

Pitch of Cutter	Depth to be Cut in Gear, Inches	Thickness of Tooth at Pitch Line, Inches	Pitch of Cutter	Depth to be Cut in Gear, Inches	Thickness of Tooth at Pitch Line, Inches
1 $\frac{1}{4}$	1.726	1.257	11	.196	.143
1 $\frac{1}{2}$	1.438	1.047	12	.180	.131
1 $\frac{3}{4}$	1.233	.898	14	.154	.112
2	1.079	.785	16	.135	.098
2 $\frac{1}{4}$	.959	.698	18	.120	.087
2 $\frac{1}{2}$	.863	.628	20	.108	.079
2 $\frac{3}{4}$	.784	.571	22	.098	.071
3	.719	.524	24	.090	.065
3 $\frac{1}{2}$	.616	.449	26	.083	.060
4	.539	.393	28	.077	.056
5	.431	.314	30	.072	.052
6	.360	.262	32	.067	.049
7	.308	.224	36	.060	.044
8	.270	.196	40	.054	.039
9	.240	.175	48	.045	.033
10	.216	.157	..	...	...

## Tooth Flanks Undercut

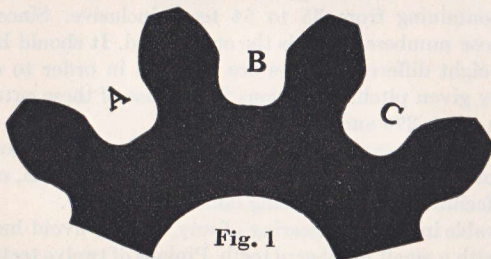


Fig. 1

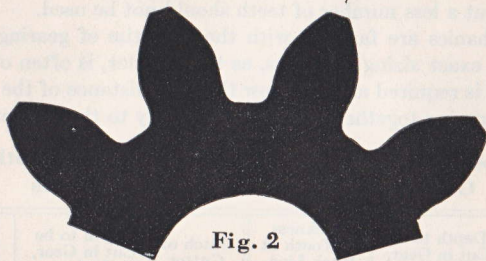


Fig. 2

IT is well known that involute gears can be made of different systems or of different angles of obliquity or pressure. In the system proposed by Professor Willis in 1838, which we adopted in 1864, the angle of pressure, or obliquity, is  $14\ 1\text{--}2^\circ$ . Twice this angle is the familiar angle of the worm-thread tool gauge in common use. Gears made upon this system are thought to crowd less upon their shafts than those having a greater angle of pressure. If, however, a gear or pinion has less than 12 teeth, this angle may cause their flanks to be undercut and in consequence weak, in order to clear the faces of an engaging gear. The cut of a segment of a gear of 10 teeth, 4 diametral pitch, Fig. 1, illustrates this undercutting, which is greater as the teeth are less.

Gears or pinions having less than 12 teeth might be unavailable if undercut as much as at A, B and C in the illustration Fig. 1. Hence, gears that are to do heavy work may require a greater angle of pressure than  $14\ 1\text{--}2^\circ$ , if they are to run with a pinion of less than 12 teeth. If a different angle is required, special cutters will have to be made at an extra cost.

Fig. 2 shows a section of a gear 10 teeth, 4 pitch. The angle of pressure is  $22\ 1\text{--}2^\circ$ . The greater strength of the tooth flanks in this figure is readily seen. The angle cannot be much more than  $32^\circ$  and have the addendum of the ordinary height, which is equal to the module.



# Comparative Sizes of Gear Teeth

## INVOLUTE



20 P



18 P



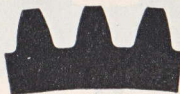
16 P



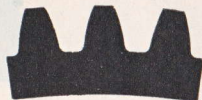
14 P



12 P



10 P



9 P



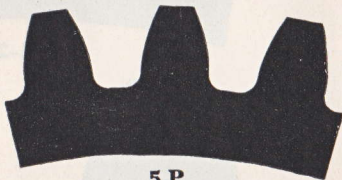
8 P



7 P



6 P



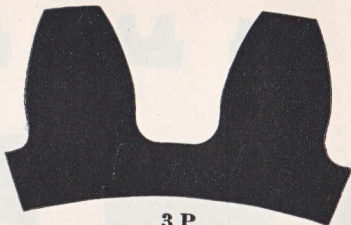
5 P



4 P

# Comparative Sizes of Gear Teeth

INVOLUTE (*Continued*)



3 P



2 1-2 P



2 P

## Bevel Gears

**T**HE curve of teeth in bevel gears, when correctly formed, changes constantly from one end of the tooth to the other. Therefore bevel gears, whose teeth are produced with a cutter of fixed curve, are not theoretically correct, the cutter usually being of a curve that will make the correct form at the outer part of the face of the gear, and of necessity will leave the curves too large at the inside ends of the teeth.

Small bevel gearing is almost universally produced in this manner, which practically answers the purpose, except when the teeth are very coarse or the gears very small, in which cases their operation is not satisfactory.

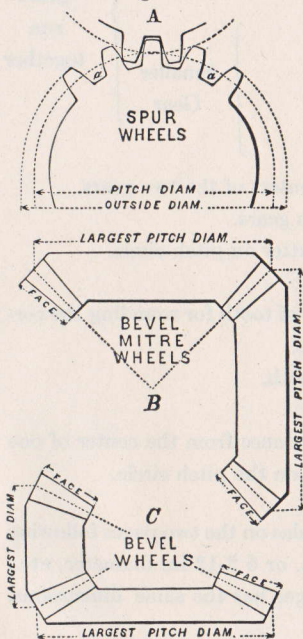
In place of cutting by changing position of cutter, etc., the teeth are often filed slightly, in order to round them off to the curve required for their free running.

On all bevel gears cut with a cutter of fixed curve, it is necessary to cut through twice owing to the necessity of making the thickness of the cutter on the pitch line about .005" thinner than the space between the teeth at the smallest pitch diameter. As the width of space between the teeth on the largest pitch diameter should be greater than the thickness of the cutter, it must be made so by passing the cutter through a second time.

The cuts on this page will explain the forms of spur, bevel and mitre gears, also the terms "pitch diameter," "outside diameter," "largest pitch diameter," "length of face," etc.

When a pair of bevel gears are of same size and number of teeth, with their lines of centers at right angles, they are called "mitre gears," and one cutter will answer for both; but where one gear has a greater number of teeth, or differs in bevel from the one running into it, then each of the pair of gears may require a different cutter.

For directions in ordering cutters for bevel gears, see pages 297-302.





## Formulas for Determining the Dimensions of Gears by Diametral Pitch

Let  $P$  denote the diametral pitch, or the number of teeth to one inch of diameter of pitch circle.

" D'	"	"	diameter of pitch circle.	}	Larger Gear	}	These gears run together
" D	"	"	whole diameter.				
" D'''	"	"	bottom diameter.				
" N	"	"	number of teeth.				
" V	"	"	velocity.	}	Smaller Gear		
" d'	"	"	diameter of circle.				
" d	"	"	whole diameter.				
" d'''	"	"	bottom diameter.				
" n	"	"	number of teeth.				
" v	"	"	velocity.				
" a	"	"	distance between the centers of the two gears.				
" b	"	"	number of teeth in both gears.				
" t	"	"	thickness of tooth or cutter on pitch circle.				
" D''	"	"	working depth of tooth.				
" f	"	"	amount added to depth of tooth for rounding the cor- ners and for clearance.				

"  $D'' + f$  denote the whole depth of tooth.

"  $\pi$  denote the constant 3.1416.

"  $P'$  denote the circular pitch or the distance from the center of one tooth to the center of the next on the pitch circle.

The examples placed opposite the formulas on the two pages following are for a single gear of 12 pitch, 6.166 in. or 6 2-12 in. diameter, etc., and in the case of the two gears the larger has the same dimensions. The velocities are respectively 1 and 2.

## Formulas for Determining the Dimensions of Gears by Diametral Pitch for a Single Gear

<i>Formulas.</i>	<i>Examples.</i>	
$P = \frac{N + 2}{D} = \frac{72 + 2}{6.166}, \text{ or } \frac{72 + 2}{6 \times 12} = 12$		1
$P = \frac{N}{D'} = \frac{72}{6} = 12$		2
$D' = \frac{D \times N}{N + 2} = \frac{6.166 \times 72}{72 + 2} = 6$		3
$D' = \frac{N}{P} = \frac{72}{12} = 6$		4
$N = P D' = 12 \times 6 = 72$		5
$N = P D - 2 = 12 \times 6.166 - 2, \text{ or } 12 \times 6 \times 12 - 2 = 72$		6
$D = \frac{N + 2}{P} = \frac{72 + 2}{12} = 6.166, \text{ or } 6 \times 12$		7
$D = D' + \frac{2}{P} = 6 + \frac{2}{12}, \text{ or } 6 + .166 = 6.166$		8
$D''' = \frac{N - 2.314}{P} = \frac{72 - 2.314}{12} = 5.807$		9
$D''' = D - 2 (D'' + f) = 6.166 - .3596 = 5.807$		10
$t = \frac{1.57}{P} = \frac{1.57}{12} = .130$		11
$D'' = \frac{2}{P} = \frac{2}{12} = .166, \text{ or } 2 \times 12$		12
$f = \frac{t}{10} = \frac{.130}{10} = .013$		13
$D'' + f = .166 + .013 = .179$		14
$P' = \frac{\pi}{P} = \frac{3.1416}{12} = .262$		15
$P = \frac{\pi}{P'} = \frac{3.1416}{.262} = 12$		16

## Formulas for Determining the Dimensions of Gears by Diametral Pitch for a Pair of Gears

<i>Formulas.</i>	<i>Examples.</i>	
$b = 2 a P = 2 \times 4.5 \times 12 = 108$		17
$n = \frac{b V}{v + V} = \frac{108 \times 1}{3} = 36$		18
$N = \frac{n v}{V} = \frac{36 \times 2}{1} = 72$		19
$n = \frac{N V}{v} = \frac{72 \times 1}{2} = 36$		20
$N = \frac{b v}{v + V} = \frac{108 \times 2}{3} = 72$		21
$n = \frac{P D' V}{v} = \frac{12 \times 6 \times 1}{2} = 36$		22
$V = \frac{n v}{N} = \frac{36 \times 2}{72} = 1$		23
$v = \frac{N V}{n} = \frac{72 \times 1}{36} = 2$		24
$v = \frac{P D' V}{n} = \frac{12 \times 6 \times 1}{36} = 2$		25
$D = \frac{2 a (N + 2)}{b} = \frac{2 \times 4.5 \times (72 + 2)}{108} = 6.166$		26
$d = \frac{2 a (n + 2)}{b} = \frac{2 \times 4.5 \times (36 + 2)}{108} = 3.166$		27
$a = \frac{b}{2 P} = \frac{108}{2 \times 12} = 4.5$		28
$D' = \frac{2 a v}{v + V} = \frac{2 \times 4.5 \times 2}{3} = 6$		29
$d' = \frac{2 a V}{v + V} = \frac{2 \times 4.5 \times 1}{3} = 3$		30
$a = \frac{D' + d'}{2} = \frac{6 + 3}{2} = 4.5$		31



## Gears

In addition to the extensive equipment employed for the cutting of hundreds of gears daily for use on our own machinery, we operate a completely equipped Gear Department for serving our many customers. With this equipment we can furnish to your order:

**Spurs Gears** to 72" in diameter.

**Planed Bevel Gears** to 18" in diameter (either the straight, angular or spiral type).

**Spiral Gears** to 36" in diameter.

**Worms and Worm Gears.**

**Racks, Clutches, etc.**

Our experience in the manufacture of gears extends over fifty years, the benefit of the accumulated experience from such an extended period of precision gear cutting being at your command.

## Gears for Motor Vehicles

Since the introduction of the Motor Vehicle, we have accumulated much valuable data on the design and results of many practical and projected forms of gears used in their manufacture. This information is entirely at the service of customers.

We have excellent facilities for producing these gears. The best equipment to be found for cutting, hardening, grinding, and testing has been installed, enabling us to insure customers prompt delivery of first-quality gears.

The Gear Department is equipped with the very latest machinery for producing Bevel Gears and can furnish them to your specifications of either the straight, angular or spiral type, the two latter types being those so generally adopted for automobile rear axles.

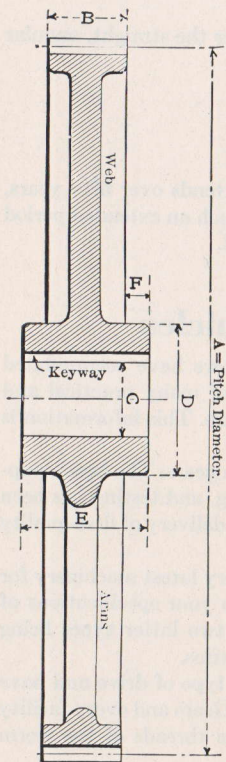
We were among the first to exploit the worm type of drive and have the most improved machinery for cutting Worm Gears and every facility for testing them. We can harden and grind the threads of the worm when required.

Quotations cheerfully given. On asking for quotations please send complete information, blue prints, etc. See next two pages for necessary data in ordering spur and bevel gears.

# Instructions for Ordering Spur Gears

Always send drawing when possible

In ordering Spur Gears, the following information should be given:



Pitch, or if preferred, Pitch Diameter, A

Number of Teeth

Width of Face, B

Diameter of Hole in Hub, C

Diameter of Hub, D

Length of Hub, E

Distance from Face of Gear to end of Hub, F.

Keyway or Set Screw, and size

Material to be used

Arms or Web

Number of revolutions per minute at which gears are to run

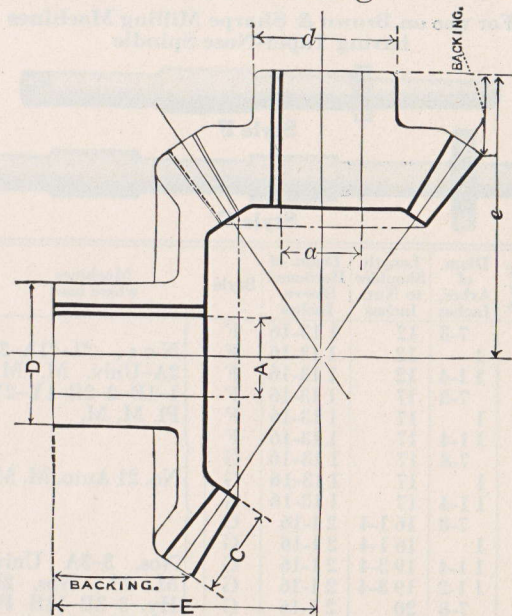
To be used for pattern, or not

Unless otherwise specified, face and ends of hubs only will be finished and stock will be left on ends of hub for fitting.

The upper half of the cut shows a section through a web gear and the lower, a section through an arm gear.

If the above information is clearly given, it will save much delay in filling orders.

# Instructions for Ordering Bevel Gears



When ordering Bevel Gears please give the following information:  
Pitch or if preferred, give diameter of pitch circle.

Number of teeth in gear.

Number of teeth in pinion.

Diameter of Hole in gear, A.

Diameter of Hole in pinion, a.

Backing for both gear and pinion.

Width of face, C.

Diameter of gear hub, D.

Diameter of pinion hub, d, if these dimensions are of importance.

Distance from center of pinion shaft to end of gear hub, E.

Distance from center of gear shaft to end of pinion hub, e.

Keyway or set screw, and size.

Material to be used.

To be used for pattern or not?

Does the pinion drive or is it driven?

Unless otherwise specified, face and ends of hubs only will be finished and stock will be left on ends of hub for fitting.



## Cutter Arbors

For use on Brown & Sharpe Milling Machines  
having Taper-Nose Spindle



Style F



Style G

No. of Arbor	No. of Taper Shank	Diam. of Arbor, Inches	Length Shoulder to Nut, Inches	Diam. of Hardened Sleeve, Inches	Style	Machines where used	Price
501	10	7-8	12	1 13-16	F	Nos. *1-*1A-2-2A-Univ. M. M.; 1-1B-2-2B-1Y-2Y Pl. M. M.	\$27.50
502	10	1	12	1 13-16	F		27.50
503	10	1 1-4	12	1 13-16	F		27.50
504	10	7-8	17	1 13-16	F		29.00
505	10	1	17	1 13-16	F		29.00
506	10	1 1-4	17	1 13-16	F		29.00
504A	10	7-8	17	1 13-16	G		33.00
505A	10	1	17	1 13-16	G		33.00
506A	10	1 1-4	17	1 13-16	G		33.00
510	11	7-8	16 1-4	2 1-16	G		33.00
511	11	1	16 1-4	2 1-16	G	Nos. 3-3A Univ. M. M.; Nos. 2B Hy.-3-3B-13B Pl. M. M.; 33 Auto M. M.	33.00
512	11	1 1-4	19 3-4	2 1-16	G		35.00
513	11	1 1-2	19 3-4	2 1-16	G		35.00
514	11	7-8	20	2 1-16	G		34.00
515	11	1	22	2 1-16	G		36.00
516	11	1 1-4	24	2 1-16	G		37.00
517	11	1 1-2	24	2 1-16	G		37.00
520	12	1	22	2 5-16	G		36.00
521	12	1 1-4	26 3-4	2 5-16	G		38.50
522	12	1 1-2	26 3-4	2 5-16	G		38.50
523	12	1 3-4	26 3-4	2 5-16	G	Nos. 4A Hy. Univ. M. M.; Nos. 4B Hy.-5B Hy. Pl. M. M.	39.00
530	14	1	25	2 9-16	G		39.00
531	14	1 1-4	29	2 9-16	G		41.00
532	14	1 1-2	29	2 9-16	G		41.00
533	14	1 3-4	29	2 9-16	G		42.00
534	14	2	29	2 9-16	G		42.00
535	14	1	30	2 9-16	G		41.00
536	14	1 1-4	35	2 9-16	G		43.00
537	14	1 1-2	35	2 9-16	G		43.00
538	14	1 3-4	35	2 9-16	G		45.00
539	14	2	35	2 9-16	G		45.00

\*With or without Back Gears. Standard Tapers and Taper Holes, page 234.

## Cutter Arbors

For use on Brown & Sharpe Milling Machines  
having Threaded-Nose Spindle



Style A



Style B



Style C



Style D



Style E

No. of Arbor	No. of Taper Shank	Diameter of Arbor, Inches	Length Shoulder to Nut, Inches	Diameter of Hardened Sleeve, Inches	Style	Price
04	7	1-2	1	....	A	\$6.75
05	7	1-2	3	....	A	7.25
07	9	5-8	4	....	A	8.00
08	9	7-8	5 1-4	....	A	8.75
09	9	1	5 1-4	....	A	8.75
010	9	5-8	8	....	A	11.75
011	9	7-8	8	....	A	11.75
012	9	1	8	....	A	11.75
1	10	5-8	4	....	A	8.75
6	10	7-8	5 1-4	....	A	11.00
7	10	1	5 1-4	....	A	11.00
9	10	1 1-4	5 1-4	....	A	11.00
10	10	7-8	8	....	A	13.50
11	10	1	8	....	A	13.50
13	10	1 1-4	8	....	A	13.50
40	10	7-8	12	1 13-16	B	21.00
41	10	1	12	1 13-16	B	21.00
43	10	1 1-4	12	1 13-16	B	21.00
44	10	7-8	17	1 13-16	B	22.00
45	10	1	17	1 13-16	B	22.00
47	10	1 1-4	17	1 13-16	B	22.00
53	10	1	14 1-2	1 13-16	D	22.50
55	10	1 1-4	14 1-2	1 13-16	D	22.50
15	11	7-8	10 1-4	....	A	16.00
16	11	1	10 1-4	....	A	16.00
18	11	1 1-4	10 1-4	....	A	16.00
48-A	11	7-8	16 1-4	2 1-16	C	27.50

Standard Tapers and Taper Holes, page 234.

List continued on next page.

## Cutter Arbors

For use on Brown & Sharpe Milling Machines  
having Threaded-Nose Spindle

(Continued)

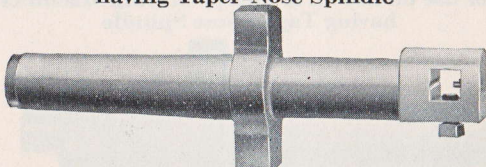
No. of Arbors	No. of Taper Shank	Diameter of Arbor, Inches	Length Shoulder to Nut, Inches	Diameter of Hardened Sleeve, Inches	Style	Price
49-A	11	1	18	2 1-16	C	\$27.50
51-A	11	1 1-4	20 1-2	2 1-16	C	30.00
52-A	11	1 1-2	20 1-4	2 1-16	C	30.00
35-A	11	7-8	16 1-4	2 1-16	E	30.00
36-A	11	1	16 1-4	2 1-16	E	30.00
38-A	11	1 1-4	19 3-4	2 1-16	E	31.50
39-A	11	1 1-2	19 3-4	2 1-16	E	31.50
19-A	11	7-8	20	2 1-16	E	31.50
20-A	11	1	22	2 1-16	E	33.50
22-A	11	1 1-4	24	2 1-16	E	35.50
23-A	11	1 1-2	24	2 1-16	E	35.50
65-A	11	1	22	2 5-16	E	33.50
66-A	11	1 1-4	26 3-4	2 5-16	E	36.00
67-A	11	1 1-2	26 3-4	2 5-16	E	36.00
68-A	11	1 3-4	26 3-4	2 5-16	E	36.00
69-A	12	1	25	2 9-16	E	36.00
70-A	12	1 1-4	29	2 9-16	E	36.00
71-A	12	1 1-2	29	2 9-16	E	36.00
71 1-2-A	12	1 3-4	29	2 9-16	E	36.00
72-A	12	2	29	2 9-16	E	36.00
75-A	12	1	30	2 9-16	E	37.00
76-A	12	1 1-4	35	2 9-16	E	38.50
77-A	12	1 1-2	35	2 9-16	E	38.50
78-A	12	1 3-4	35	2 9-16	E	38.50
79-A	12	2	35	2 9-16	E	38.50

Standard Tapers and Taper Holes, page 234.



## Fly Cutter Arbors

For use on Brown & Sharpe Milling Machines  
having Taper-Nose Spindle

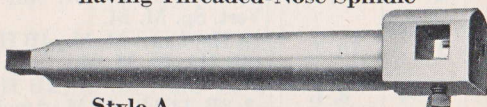


No. of Arbor.	No. of Taper Shank	Machines where used	Square Hole, Inches	Price
590	10	{ *1-*1A-2-2A Univ. M. M.; *1-1B-2-2B Pl. M. M.; 21 Auto. M. M.	3-4	\$22.00
591	11	{ 3-3A Univ. M. M.; 3-3B-13B Pl. M. M.; 2-5 Vert. Sp. M. M.; 33 Auto M. M.	3-4	25.50
592	12	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M.	3-4	35.00
593	14	{ 4A Hy. Univ. M. M.; 4B Hy.-5B Hy. Pl. M. M.	3-4	38.00

\*With or without back gears.

Price includes tool with 1-8" radius.

For use on Brown & Sharpe Milling Machines  
having Threaded-Nose Spindle



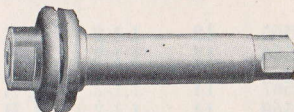
**Style A**  
The hole in the head is 3-4" square.

No. of Arbor	Style	No. of Taper	Price
110	A	10	\$11.75
112	A	11	14.75
113	A	12	16.00

Price includes tool with 1-8" radius.

## Screw Slotting Cutter Arbors

These arbors are for use with Screw Slotting Cutters and are adapted for use on Centers. The following sizes are carried in stock: 3-8", 1-2", 5-8", 3-4", 7-8", 1". Price each, \$6.75.

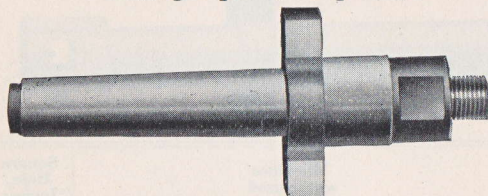


They are also made with No. 7 Taper Shank for use on the Screw Slotting Machine and can be furnished at short notice.

Screw Slotting Cutters, pages 286 and 287.  
Standard Tapers and Taper Holes, page 234.

## Screw Arbors

For use on Brown & Sharpe Milling Machines  
having Taper-Nose Spindle



No. of Arbor	No. of Taper	Diam. of Arbor, Inches	Thread for Cutter	Machines where used	Price
551	10	1	10, L	{ *1-*1A-2-2A Univ. M. M.; *1-*1B-2-2B-1Y-2Y Pl.; 21 Auto. M. M. }	\$12.00
†552	10	1	10, R		12.00
553	11	1	10, L	{ 3-3A Univ. M. M.; 2B Hy. -3-3B-13B Pl. M. M.; 2 and 5 Vert. Sp. M. M.; 33 Auto M. M. }	17.00
†554	11	1	10, R		17.00
555	12	1	10, L	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M. }	18.00
556	14	1	10, L		20.00
557	11	1 1-4	8, L	{ 3-3A Univ. M. M.; 2B Hy. -3-3B-13B Pl. M. M.; 2 and 5 Vert. Sp. M. M.; 33 Auto M. M. }	17.00
†558	11	1 1-4	8, R		17.00
559	12	1 1-4	8, L	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M. }	18.00
†560	12	1 1-4	8, R		18.00
561	14	1 1-4	8, L	{ 4A Hy. Univ. M. M.; 4B Hy.-5B Hy. Pl. M. M. }	20.00
†562	14	1 1-4	8, R		20.00
563	11	1 1-2	8, L	{ 3-3A Univ. M. M.; 2B Hy. -3-3B-13B Pl. M. M.; 2 and 5 Vert. Sp. M. M.; 33 Auto M. M. }	17.00
564	11	1 1-2	8, R		17.00
565	12	1 1-2	8, L	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M. }	18.00
†566	12	1 1-2	8, R		18.00
567	14	1 1-2	8, L	{ 4A Hy. Univ. M. M.; 4B Hy.-5B Hy. Pl. M. M. }	20.00
†568	14	1 1-2	8, R		20.00

\*With or without back gears.

†These Arbors are not carried in stock, but can be furnished at short notice.

Standard Tapers and Taper Holes, page 234.

## Screw Arbors

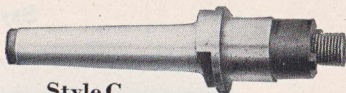
For use on Brown & Sharpe Milling Machines  
having Threaded-Nose Spindle



Style A



Style B



Style C

Style D.—Similar to Style C, but has threaded hole in end for drawing-in bolt.

In ordering, state whether Right- or Left-Hand Arbors are wanted.

No. of Arbor	No. of Taper	Diam. of Arbor, Inches	Thread	Style	Price
120	7	3-8	20, L	A	\$3.75
122	9	1-2	16, L	A	5.00
128	10	1	10, L	B	9.75
†129	10	1	10, R	B	9.75
130	11	1	10, L	B	11.00
*131	10	1	10, L	D	9.75
*†132	10	1	10, R	D	9.75
133	11	1	10, L	C	12.75
†134	11	1	10, R	C	12.75
135	12	1	10, L	C	16.00
138	11	1	10, L	D	12.75
†139	11	1	10, R	D	12.75
142	11	1 1-4	8, L	C	14.00
†143	11	1 1-4	8, R	C	14.00
146	11	1 1-4	8, L	D	14.00
†147	11	1 1-4	8, R	D	14.00
150	12	1 1-4	8, L	C	16.00
†151	12	1 1-4	8, R	C	16.00
154	12	1 1-4	8, L	D	16.00
†155	12	1 1-4	8, R	D	16.00
158	11	1 1-2	8, L	C	14.00
†159	11	1 1-2	8, R	C	14.00
162	11	1 1-2	8, L	D	14.00
†163	11	1 1-2	8, R	D	14.00
166	12	1 1-2	8, L	C	16.00
†167	12	1 1-2	8, R	C	16.00
170	12	1 1-2	8, L	D	16.00
†171	12	1 1-2	8, R	D	16.00

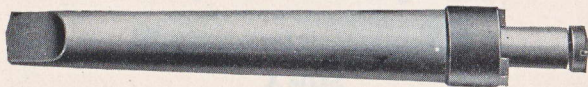
\*Does not have clutch drive.

†These Arbors are not carried in stock, but can be furnished at short notice.

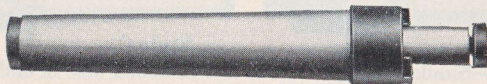
Standard Tapers and Taper Holes, page 234.



## Arbors for Shell-End Mills



Style A



Style B

No. of Arbor	No. of Taper	Diameter of Arbor, Inches	Diameter Mills Arbor Will Take, Inches	Style	Price
89	7	1-2	1 1-4 to 1 1-2	A	\$8.00
90	9	3-4	1 9-16 to 2 3-16	A	8.00
91	9	1	2 1-4 to 3	A	8.25
92	9	1-2	1 1-4 to 1 1-2	B	8.00
93	9	1-2	1 1-4 to 1 1-2	A	8.00
94	10	3-4	1 9-16 to 2 3-16	A	9.25
95	10	1	2 1-4 to 3	A	9.75
96	9	3-4	1 9-16 to 2 3-16	B	8.00
105	9	1	2 1-4 to 3	B	8.25
97	10	3-4	1 9-16 to 2 3-16	B	9.25
98	10	1	2 1-4 to 3	B	9.75

### Machines Where Used

Arbor No. 89 on No. 1 Vert. Sp. M. Att.; No. 1 Comp. Vert. Sp. M. Att.; No. 1 Univ. M. Att.

Arbors Nos. 90-91-92-93-96-105 on Nos. 00-0-0Y Plain Mill. Machines; No. 2 Vert. Sp. M. Att.; No. 2 Comp. Vert. Sp. M. Att.; Nos. 2-3-4 Univ. M. Att.

Arbors Nos. 97-98 on Nos. \*1-\*1A-2-2A Univ. M. M.; Nos. \*1-\*1B-2-2B-1Y-2Y Plain and 21 Auto. M. M.

\*With or without Back Gears.

**In ordering, state whether Arbor is for Right- or Left-Hand Mill.**

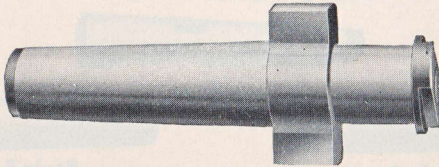
Style A Arbors can be used on larger machines by the use of collets. Collets, listed pages 338 and 339.

Morse Taper furnished when desired.

Standard Tapers and Taper Holes, page 234. List of Mills, page 273.

## Arbors for Face Milling Cutters

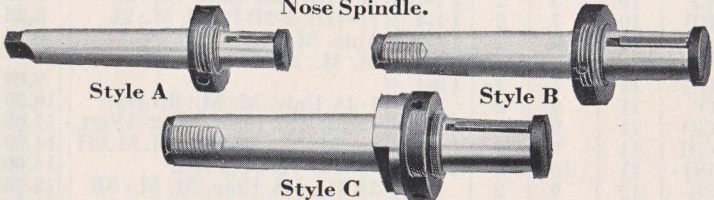
For use on Brown & Sharpe Milling Machines having Taper-Nose Spindle



No. of Arbor	No. Taper Shank	No. Taper for Mill	Machines where used	Price
580	10	14	{*1-*1A-2-2A Univ. M. M.; *1-*1B-2-2B Pl. M. M.; 2I Auto. M. M.	\$20.00
581	11	14		
582	12	14	{3-3A Univ. M.M.; 3-3B-13B Pl. M. M.; 2-5 Vert. Sp. M. M. 33 Auto. M.M.	20.00
583	14	14		
			{3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M.	22.00
			{4A Hy. Univ. M. M.; 4B Hy.-5B Hy. Pl. M. M.	24.00

\*With or without Back Gears.

For use on Brown & Sharpe Milling Machines having Threaded-Nose Spindle.



Style A

Style B

Style C

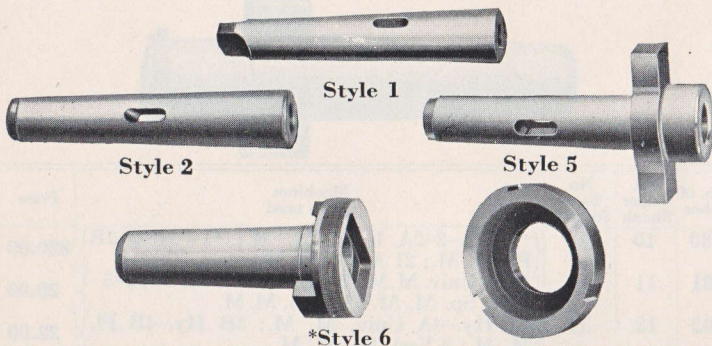
Style D. Similar to Style C, but no threaded hole.

No. of Arbor	No. of Taper of Shank	No. of Taper for Mill	Style	Price
79	10	10	A	\$14.00
82	11	12	A	18.00
81	11	12	B	18.00
80	11	10	C	21.50
83	11	12	C	21.50
87	12	12	C	21.50
84	11	12	D	21.50
85	12	12	D	21.50
86	12	10	C	21.50

Standard Tapers and Taper Holes, page 234.

## Collets

For use on Brown & Sharpe Milling Machines  
having Taper-Nose Spindle



\*Style 6

Mark	Out- side Taper	Inside Taper	Style	Collet to Spindle, Inches	Machines where used	Price
AA	7	4	1	5-16	1 High-Speed Milling Att. †1-†1A-2-2A Univ. M. M.; †1-†1B-2-2B Pl. M. M.; 21 Auto. M. M.; 1 Vert. Sp. M. M.; 1H Vert. Sp. Att.	\$4.25
EF	10	5	2	2 1-16		7.50
BB	10	7	2	1 1-4		8.25
FF	10	9	2	1 1-4		8.25
QQ	11	7	2	1 3-4	3-3A Univ. M. M.; 2B Hy. -3-3B-13B Pl. M. M.; 2-5 Vert. Sp. M. M.; 33 Auto. M. M. 2H -3-4-5 Vert. Sp. Att. 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M.; 3H Vert. Sp. M. Att. 4A Hy. Univ. M. M.; 4H-5H Vert. Sp. M. Att.; 4B Hy. -5B Hy. Pl. M. M. 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M.; 3H Vert. Sp. M. Att. 4A Hy. Univ. M. M.; 4B Hy. -5B Hy. Pl. M. M.; 4H-5H Vert. Sp. M. Att.	9.00
O	11	9	2	1-4		10.50
GO	11	9	5	2		14.00
GH	11	9	5	1		14.00
PQ	11	10	5	1 3-4		14.00
SS	12	9	2	7-16		12.50
ST	12	9	5	1 1-4		14.00
OP	12	10	5	1 1-2		14.00
TU	14	9	5	1 1-4	3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M.; 3H Vert. Sp. M. Att. 4A Hy. Univ. M. M.; 4B Hy. -5B Hy. Pl. M. M.; 4H-5H Vert. Sp. M. Att.	15.00
*AB	12	11	6	1 3-8		35.00
*CD	14	12	6	1 1-8	4A Hy. Univ. M. M.; 4B Hy. -5B Hy. Pl. M. M.; 4H-5H Vert. Sp. M. Att.	45.00

\*Will permit arbors D and E for Threaded-Nose Spindle to be used with Taper-Nose Spindle.  
†With or without Back Gears.

Standard Tapers and Taper Holes, page 234.



## Collets

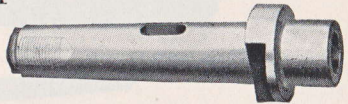
Tools for use on Brown & Sharpe Milling Machines  
having Threaded-Nose Spindle



Style 1



Style 2



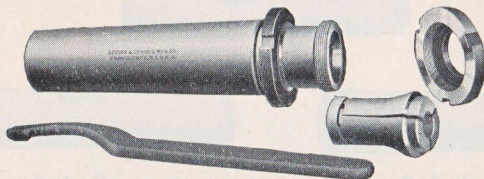
Style 3

Style 1A. Similar to Style 1, but designed for shanks without tenons.  
Style 2A. Similar to Style 2, but no threaded hole. Style 3A. Similar to  
Style 3, but no threaded hole.

Mark	Outside Taper	Inside Taper	Style	Collet to Spindle, Inches	Diam. Threaded Hole, Inches	Price
A	7	4	1A	1 9-16	.....	\$4.25
J	7	4	2	5-16	3-8, 16, L. H.	4.25
N	7	5	1A	2 5-16	.....	4.25
R	7	5	2	3-4	3-8, 16, L. H.	4.25
C	9	5	1A	2 1-8	.....	5.75
D	9	5	1A	3-4	.....	5.25
K	9	5	2	3-8	7-16, 14, L. H.	5.25
KK	9	7	1	3-4	.....	6.75
RR	9	7	2	7-8	7-16, 14, L. H.	6.75
EE	10	5	1A	2 1-16	.....	7.50
DD	10	7	1	2 5-8	.....	7.50
E	10	7	1	1 5-8	.....	7.50
BB	10	7	2	1 1-4	1-2, 14, L. H.	8.25
Z	10	7	2A	1-2	.....	7.50
F	10	9	1	1	.....	8.25
FF	10	9	2	1 1-4	1-2, 14, L. H.	8.25
Q	11	7	1	1 3-4	.....	9.00
G	11	9	1	2 3-8	.....	9.75
O	11	9	2	1-4	3-4, 12, L. H.	10.50
H	11	9	3	1 5-8	3-4, 12, L. H.	12.50
GG	11	10	3A	1-2	.....	12.50
SS	12	9	2	7-16	3-4, 12, L. H.	12.50
T	12	9	3A	1 11-16	.....	18.00
V	12	10	2	7-8	3-4, 12, R. H.	13.00
P	11	10	1	1 3-8	.....	13.00
PP	12	10	3A	1 11-16	.....	18.00
VV	12	11	2	1 7-8	3-4, 12, R. H.	13.00
TT	12	11	3A	1 11-16	.....	18.00
UU	12	9	3	1 11-16	3-4, 12, L. H.	18.00
WW	14	10	2	7-8	3-4, 12, R. H.	18.00
W	14	11	2	7-8	3-4, 12, R. H.	18.00
WV	14	12	2	7-8	3-4, 12, R. H.	18.00
XX	16	11	2	7-8	7-8, 10, R. H.	37.00
X	16	12	2	7-8	7-8, 10, R. H.	37.00
YY	18	11	2	7-8	1, 10, R. H.	44.00
Y	18	14	2	7-8	1, 10, R. H.	44.00

## Spring Chucks for Milling Machines

Can be used on Machines with either Taper- or Threaded-Nose Spindle



This Chuck is found convenient for holding wire, small rods, straight shank drills, mills, etc.

The Collet Holder is of steel, ground to fit a standard taper hole, and has a hole its entire length. The spring collet is held in place by a cap nut that forces it against the taper seat and closes the chuck centrally.

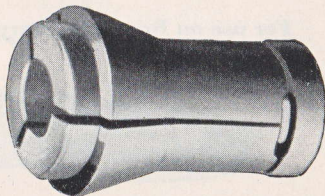
No. of Chuck	No. of Outside Taper	Hole Through, Inches	Machines where used	R'nd Coll. Furn.		Price
				No.	Size, Inches	
150	7	5-16	{ 0 and 1 Vert. Sp. Att. 1 Comp. and 1 Univ. Mill. Att.	00	1-4	\$16.00
152	9	1-2	{ 00-0-0Y Pl. M. M. 6 Univ. Index Centers	00	5-16	16.00
154	10	21-32	{ *1-*1A-2-2A Univ. *1-*1B-1Y-2-2B-2Y Pl.; and 21 Auto. M. M. 1 Vert. Sp. M. M. 10" and 12" Pl. and 10" Univ. Index Centers	10	3-8	20.00
156	11	3-4	{ 2A Hy.-3-3A Univ. M. M. 12" and 14" Univ. Index Cent. 2 Hy.-2B Hy.-3-3B-13 B Pl. 2 and 5 Vert. Sp. M. M. 33 Auto. M. M.	21	5-8	21.00
158	12	1	{ 3A Hy.-4A Univ. M. M. 3B Hy.-4B Pl. M. M. 12 1-2" and 15" Univ. Index Centers; 3 Vert. Sp. M. M.	21	5-8	24.00
160	14	1	{ 4A Hy.-4B Hy.-5B Hy. Pl. M. M.	21	5-8	26.50

\*With or without back gears.

Standard Tapers and Taper Holes, page 234.

## Spring Collets

**For use with Spring  
Chucks for Milling  
Machines**



No. 00, for Chucks Nos. 150 and 152, Round, 1-16" to 1-2" by 64ths.....	Price
Square or Hexagonal, made to order.....	\$4.00
No. 10, for Chuck No. 154, Round, 1-16", 3-32" to 5-16", by 64ths; 11-32" to 1-2", by 32nds; 9-16", 5-8".....	8.00
Square, 3-16" and 1-4".....	4.75
Hexagonal, 3-16", 1-4", and 5-16".....	8.00
No. 21, for Chucks Nos. 156, 158, and 160, Round, 1-8" to 21-32" by 32nds; 11-16" to 1", by 16ths.....	8.00
Square, 1-4", 5-16", 3-8", and 7-16".....	5.25
Hexagonal, 1-4", 5-16", 3-8", 7-16", and 1-2".....	8.25
Other sizes made to order.	

## Collet Blanks



Price includes Turning Plug and Knockout Key.

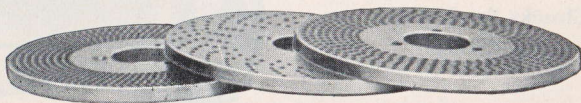
Diameter, Inches	Length Over All, Inches	No. of Taper Hole	Price
3-4	5 1-4	4	\$4.20
1 1-8	8 1-2	5	5.60
1 5-8	10	7	8.40
1 5-8	12	9	9.50
2	14	10	10.50

Standard Tapers and Taper Holes, page 234.



## Index Plates

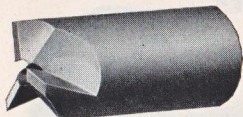
For use on Brown & Sharpe Universal Milling Machines



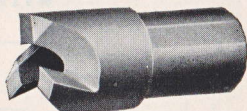
It is sometimes necessary to use the spiral head to furnish divisions which are not covered by the three index plates furnished with each of our Universal Milling Machines. We therefore are prepared to furnish index plates for use with the spiral head which contain circles with the number of holes listed below:

No.	Machine where used	Diameter of Plate, Inches	Hole in Center, Inches	Number of Holes in Each Circle	Price
1	No. 1 Without Back Gears Prior to 1900	4 3-4	1 1-8	15 16 17 18 19 20	\$5.00
2		4 3-4	1 1-8	21 23 27 29 31 33	5.00
3		4 3-4	1 1-8	37 39 41 43 47 49	5.00
7	Nos. 1, 1A Without Back Gears 1, 1A, With Back Gears 2 and 2A	5	1 1-8	15 16 17 18 19 20	5.00
8		5	1 1-8	21 23 27 29 31 33	5.00
9		5	1 1-8	37 39 41 43 47 49	5.00
13	2A Heavy 3 and 3A	6 1-4	1 1-2	15 16 17 18 19 20	6.75
14		6 1-4	1 1-2	21 23 27 29 31 33	6.75
15		6 1-4	1 1-2	37 39 41 43 47 49	6.75
20	No. 4 Prior to 1893	6 15-16	1 1-2	15 16 17 18 19 20	6.75
21		6 15-16	1 1-2	21 23 27 29 31 33	6.75
22		6 15-16	1 1-2	37 39 41 43 47 49	6.75
28	3A Heavy 4A and 4A Heavy	7 1-2	1 3-4	15 16 17 18 19 20	6.75
29		7 1-2	1 3-4	21 23 27 29 31 33	6.75
30		7 1-2	1 3-4	37 39 41 43 47 49	6.75

## Plain Hollow Mills



The Plain Hollow Mills are designed for use in the turbines of screw machines for roughing cuts. They are made



with two forms of teeth, one undercut, for milling steel, and one straight, for milling brass. These mills turn large as follows: up to and including 7-32", approximately, .007"; 1-4" to 11-16" inclusive, approximately .011."

No. of Mill	Style	No. of Machine where used	Sizes Carried in Stock, Inches	Diameter of Shank, Inches	Length of Shank, Inches	Diameter of Head, Inches	Length of Head, Inches	Total Length, Inches	Carbon Steel Mills, Price	High-Speed Steel Mills, Price
†00C	2	00, 00G and }	$\frac{1}{16}$ to $\frac{7}{32}$	No. 5 Taper		$\frac{1}{2}$		$1\frac{1}{8}$	\$1.70	\$2.50
*00D	2	19 Auto. }	by 64ths			$\frac{1}{2}$		$1\frac{1}{8}$	1.70	2.50
20A	3	{0and0G Au. 1 W.F. }	$\frac{1}{8}$ to $\frac{5}{16}$ by 64ths	$\frac{5}{8}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1\frac{3}{4}$	2.40	3.60
*20B	3	{0and0G Au. 1 W.F. }	$\frac{1}{8}$ to $\frac{3}{8}$ by 32ds	$\frac{5}{8}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1\frac{3}{4}$	2.40	3.60
21A	2	1 Auto. }	$\frac{1}{8}$ to $\frac{3}{8}$ by 32ds	$\frac{3}{4}$		$\frac{3}{4}$		2	2.80	4.00
22A	2	{2and2G Au. 2 & 2F W.F. }	$\frac{1}{4}$ to $\frac{7}{16}$ by 32ds	1		1		$2\frac{1}{4}$	2.80	4.10
22C	3	{2and2G Au. 2 & 2F W.F. }	$\frac{15}{32}$ to $\frac{11}{16}$ by 32ds	1	$1\frac{3}{16}$	$1\frac{1}{4}$	$1\frac{1}{16}$	$2\frac{1}{4}$	3.45	5.00

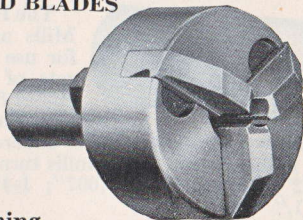
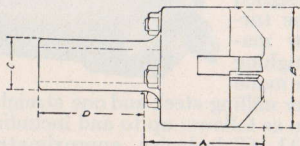
\*For Brass. †Made in both Right- and Left-Hand Styles. Unless specified otherwise we ship Right-Hand.

## Hollow Mill Blanks

The shanks of the blanks are finished and drilled. State style wanted when ordering.

Style	No. of Machine where used	Carbon Steel Price	High-Sp'd Steel Price
2	For Nos. 00, 00G and 19 Automatic	\$0.45	\$0.75
3	For Nos. 0 and 0G Automatic	.50	1.15
2	For No. 1 Automatic	.75	
2	For Nos. 2 and 2G Automatic	.75	2.35
3	For Nos. 2 and 2G Automatic	.75	2.85

## Adjustable Hollow Mills WITH INSERTED BLADES



### Roughing

Each holder is furnished with one set of blades (3) of any regular size required. The blades are held firmly in position by a simple clamping device, which is operated by nuts at the back of head.

Blades turn large, as follows: 1-4" to 7-16", about .012"; 1-2" to 3-4", about .016"; 13-16" to 1 1-8", about .02". Blades for Nos. 3, 4, and 5 interchangeable.

The stock sizes of blades run by 16ths of an inch between the limits given under "Capacity," except on Nos. 00 and 0 Mills.

Set of blades turns one size only except where noted.

**When ordering specify turning size of blades wanted.**

No. of Mill	Number of Machine where used	Capacity, Inches	A Length of Body and Blades, Inches	B Diameter Outside, Inches	C Diameter of Shank, Inches	D Length of Shank, Inches	Price with one set of Carbon Steel Blades	Price with one set of High-Speed Steel Blades	Price of extra Carbon Steel Blades, per set	Price of extra High-Speed Steel Blades, per set
†00	00, 00G, 19 Auto.	.03 to 3-8	1 3-16	1 1-2	5-8	1 1-8	\$11.00	\$12.00	\$3.00	\$4.00
†0	0 Wire Feed	.03 to 3-8	1 1-4	1 3-4	5-8	1 7-16	18.00	19.00	4.50	5.50
1	1 Pl. begin'g 230*	3-16 to 1-2	2 1-2	2 1-4	3-4	2	20.50	22.50	7.00	9.50
3	1 Wire Feed									
3	2 Pl. begin'g 455*	1-4 to 3-4	3 1-4	3	1	2 1-2	22.00	24.75	8.75	11.50
4	2 and 2F Wire Fd.									
4	4 Pl. prior to 428*	1-4 to 3-4	3 1-4	3	1 1-16	3 1-4	22.00	24.75	8.75	11.50
4	5 Pl. prior to 428*									
5	6 Pl. prior to 59*	1-4 to 3-4	3 1-4	3	1 1-4	3 1-4	22.00	24.75	8.75	11.50
6	4 Pl. 428 to 601*									
6	4 W.F. prior to 23*	1-2 to 1 1-8	3 3-8	3 1-2	1 1-2	3 1-4	25.00	28.00	10.00	12.50
6	5 Pl. 428 to 581*									
6	6 Pl. 59 to 230*									
24	4 and 5 Pl.; 4 W. F.	1-2 to 1 3-16	3 3-8	3 1-2	1 3-4	3 1-4	27.00	30.00	10.00	12.50
26	6 Pl. and 6 W. F.	1-2 to 1 3-8	3 3-8	3 3-4	2	3 1-4	29.00	32.00	11.00	13.50

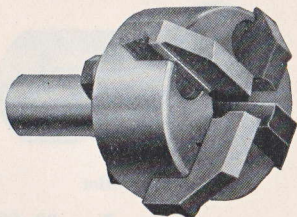
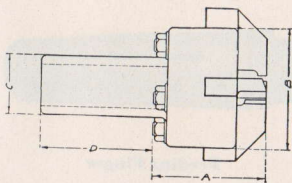
\*Be sure to give serial number of machine.

†One set of blades turns all sizes within capacity.



## Adjustable Hollow Mills

### WITH INSERTED BLADES



### Finishing

The Finishing Mills have two blades and two back rests which will turn any size within the capacity of the mill.

The blades are held firmly in position by a simple clamping device, which is operated by nuts at the back of the head.

Two extra blades are included in "Price of Mill Complete."

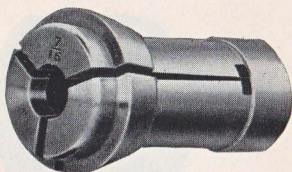
Blades for Nos. 13, 14, and 15 interchange.

No. of Mill	Number of Machine where used	Capacity, Inches	Length of Body and Blades, Inches	A	B	Diameter Outside, Inches	C	Diameter of Shank, Inches	D	Length of Shank, Inches	Price of Mill Complete with Carbon Steel Blades	Price of Mill Complete with High-Speed Steel Blades	Price of 4 Carbon Steel Blades	Price of 4 High-Speed Steel Blades	Price of 2 Back Rests
100	00, 00G, 19 Auto.	.03 to $\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$\frac{5}{8}$	$1\frac{1}{8}$	$1\frac{1}{8}$	\$13.25	\$14.50	\$2.50	\$5.00	\$1.25			
10	0 Wire Feed	.03 to $\frac{3}{8}$	$1\frac{1}{4}$	$1\frac{3}{4}$	$\frac{5}{8}$	$1\frac{1}{8}$	$1\frac{1}{8}$	21.75	24.00	4.75	7.00	1.75			
11	1 Pl. begin'g 230*	$\frac{3}{16}$ to $\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$\frac{3}{4}$	2	24.00	26.50	5.75	8.50	2.25				
11	1 Wire Feed	$\frac{3}{16}$ to $\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$\frac{3}{4}$	2	24.00	26.50	5.75	8.50	2.25				
13	2 Pl. begin'g 455*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	1	$2\frac{1}{2}$	25.50	30.00	8.00	13.00	2.75				
13	2 & 2F Wire Feed	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	$1\frac{1}{16}$	$3\frac{1}{4}$	25.50	30.00	8.00	13.00	2.75				
14	4 Pl. prior to 428*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	$1\frac{1}{4}$	$3\frac{1}{4}$	25.50	30.00	8.00	13.00	2.75				
14	5 Pl. prior to 428*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	$1\frac{1}{4}$	$3\frac{1}{4}$	25.50	30.00	8.00	13.00	2.75				
15	6 Pl. prior to 59*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	$1\frac{1}{4}$	$3\frac{1}{4}$	25.50	30.00	8.00	13.00	2.75				
15	4 Pl. 428 to 601*	$\frac{1}{2}$ to $1\frac{1}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{1}{4}$	29.50	35.00	10.00	16.00	3.00				
16	4 W. F. prior to 23*	$\frac{1}{2}$ to $1\frac{1}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{1}{4}$	29.50	35.00	10.00	16.00	3.00				
16	5 Pl. 428 to 581*	$\frac{1}{2}$ to $1\frac{1}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{1}{4}$	29.50	35.00	10.00	16.00	3.00				
16	6 Pl. 59 to 230*	$\frac{1}{2}$ to $1\frac{1}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{1}{4}$	29.50	35.00	10.00	16.00	3.00				
34	4 & 5 Pl.; 4 W. F.	$\frac{1}{2}$ to $1\frac{3}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{3}{4}$	$3\frac{1}{4}$	31.00	36.50	10.00	16.00	3.00				
36	6 Pl. & 6 W. F.	$\frac{1}{2}$ to $1\frac{3}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	2	$3\frac{1}{4}$	33.00	38.50	10.00	16.00	3.00				

\*Be sure to give serial number of machine.

# Spring Collets and Feeding Fingers

For Automatic and Wire Feed Screw Machines



Spring Collet



Feeding Finger

Nos. 00, 00G and 19 Automatic

## No. 00 Spring Collets:

Price,  
Each

Round: 1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16" .....	\$4.00
Square: 3-32", 1-8", 5-32", 3-16", 7-32" .....	8.00
Hexagonal: 1-8", 5-32", 3-16", 7-32", 1-4" .....	8.00
Metric, Round: 2 m/m to 8 m/m, varying by 1-2 m/m. ....	4.00
Collet Blanks .....	2.35

## No. 00 Feeding Fingers:

Round: 1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16" .....	2.25
Square: 3-32", 1-8", 5-32", 3-16", 7-32" .....	4.00
Hexagonal: 1-8", 5-32", 3-16", 7-32", 1-4" .....	4.00
Metric, Round: 2 m/m to 8 m/m, varying by 1-2 m/m. ....	2.25
Feeding Finger Blanks .....	1.10

## No. 00 Spring Collets, for use with 3-8" Feed Tube:

Round: 21-64", 11-32", 3-8" .....	4.00
Square: 1-4" .....	8.00
Hexagonal: 9-32", 5-16" .....	8.00
Metric, Round: 8 1-2, 9, 9 1-2 m/m .....	4.00
Collet Blanks .....	2.35

## \*No. 00A Feeding Fingers, for 3-8" Feed Tube:

Round: 21-64", 11-32", 3-8" .....	2.25
Square: 1-4" .....	4.00
Hexagonal: 9-32", 5-16" .....	4.00
Metric, Round: 8 1-2, 9, 9 1-2 m/m .....	2.25
Feeding Finger Blanks .....	1.10

\*Two feed tubes are furnished with No. 19 Automatic, one taking No. 00 Feeding Fingers and the other No. 00A Feeding Fingers. 3-8" Feed Tube for Nos. 00 and 00G Automatics is furnished as an extra.

List continued on next page.

Other sizes made to order.

# Spring Collets and Feeding Fingers—Continued

Nos. 0 and 0G Automatic, also No. 1 Wire Feed

(Prior to Machine Serial No. 227)

## No. 11 Spring Collets:

Price,  
Each

Round: 1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 21-64", 11-32", 23-64", 3-8", 25-64", 13-32", 27-64", 7-16", 29-64", 15-32", 1-2".....	\$4.75
Square: 3-16", 1-4", 5-16", 3-8".....	8.00
Hexagonal: 3-16", 1-4", 5-16", 3-8", 7-16".....	8.00
Metric, Round: 6 m/m to 12 m/m, varying by 1-2 m/m.....	4.75
Collet Blanks.....	2.65

## No. 11 Feeding Fingers:

Round: 1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 21-64", 11-32", 23-64", 3-8", 25-64", 13-32", 27-64", 7-16", 29-64", 15-32", 1-2".....	3.00
Square: 3-16", 1-4", 5-16", 3-8".....	4.25
Hexagonal: 3-16", 1-4", 5-16", 3-8", 7-16".....	4.25
Metric, Round: 6 m/m to 12 m/m, varying by 1-2 m/m.....	3.00
Feeding Finger Blanks.....	1.45

## Nos. 0 and 0G Automatic

### No. 11 Spring Collets, for use with 5-8" Feed Tube:

Round: 17-32", 9-16", 19-32", 5-8".....	4.75
Hexagonal: 1-2".....	8.00
Metric, Round: 12 1-2 m/m to 16 m/m, varying by 1-2 m/m.....	4.75
Collet Blanks.....	2.65

### No. 11A Feeding Fingers, for 5-8" Feed Tube:

Round: 17-32", 9-16", 19-32", 5-8".....	3.00
Hexagonal: 1-2".....	4.25
Metric, Round: 12 1-2 m/m to 16 m/m, varying by 1-2 m/m.....	3.00
Feeding Finger Blanks.....	1.45

### No. 11 Spring Collets, for use with Outside Feeding Attachment:

Round: 9-16", 5-8", 11-16", 3-4", 13-16".....	4.75
Hexagonal: 1-2", 9-16", 5-8", 11-16".....	8.00
Metric, Round: 14 m/m to 20 m/m, varying by 1 m/m.....	4.75
Collet Blanks.....	2.65

### No. 20C Feeding Finger, for use with Outside Feeding Attachment:

Round: Takes interchangeable sets of pads for any size round stock from 9-16" to 13-16", inclusive.....	19.00
Hexagonal: Takes interchangeable sets of pads for any size hexagonal stock from 1-2" to 11-16", inclusive.....	19.00
Square: Takes interchangeable sets of pads for any size square stock from 3-8" to 9-16", inclusive.....	19.00

### Pads for 20C Feeding Fingers:

Round: From 9-16 to 13-16, inclusive, by 16ths, sets of three.....	6.00
*Hexagonal: from 1-2" to 11-16" inclusive, set of three.....	8.00
*Square: From 3-8" to 9-16" inclusive, set of four.....	8.00
*Metric: Round from 14 m/m to 20 m/m.....	6.00

\*Made to order.

List continued on next page.

Other sizes made to order.



## Spring Collets and Feeding Fingers—Continued

### No. 0 Wire Feed

#### No. 10 Spring Collets:

Price,  
Each

Round: 1-16", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 11-32", 3-8".....	\$4.75
Square: 3-16", 1-4".....	8.00
Hexagonal: 3-16", 1-4", 5-16".....	8.00
Metric, Round: 4 m/m to 10 m/m, varying by 1-2 m/m.....	4.75
Collet Blanks.....	2.65

#### No. 10 Feeding Fingers:

Round: 1-16", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 11-32", 3-8".....	3.00
Square: 3-16", 1-4".....	4.25
Hexagonal: 3-16", 1-4", 5-16".....	4.25
Metric, Round: 4 m/m to 10 m/m, varying by 1-2 m/m.....	3.00
Feeding Finger Blanks.....	1.45

#### No. 10 Spring Collets, for use with 1-2" Feed Tube:

Round: 13-32", 7-16", 15-32", 1-2".....	4.75
Hexagonal: 3-8" and 7-16".....	8.00
Collet Blanks.....	2.65

#### No. 11C Feeding Fingers, for use with 1-2" Feed Tube:

Round: 13-32", 7-16", 15-32", 1-2".....	3.00
Hexagonal: 3-8" and 7-16".....	4.25
Feeding Finger Blanks.....	1.45

### No. 1 Automatic, also No. 1 Wire Feed (Commencing Machine Serial No. 227)

#### No. 21 Spring Collets:

Round: 1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8".....	5.25
Square: 1-4", 5-16", 3-8", 7-16".....	8.25
Hexagonal: 1-4", 5-16", 3-8", 7-16", 1-2".....	8.25
Metric, Round: 6 m/m to 16 m/m, varying by 1-2 m/m.....	5.25
Collet Blanks.....	3.00

#### No. 21 Feeding Fingers:

Round: 1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8".....	3.00
Square: 1-4", 5-16", 3-8", 7-16".....	4.25
Hexagonal: 1-4", 5-16", 3-8", 7-16", 1-2".....	4.25
Metric, Round: 6 m/m to 16 m/m, varying by 1-2 m/m.....	3.00
Feeding Finger Blanks.....	1.45

#### No. 21 Spring Collets, for use with 3-4" Feed Tube:

Round: 21-32", 11-16", 23-32" and 3-4".....	5.25
Hexagonal: 9-16", and 5-8".....	8.25
Collet Blanks.....	3.00

List continued on next page.

Other sizes made to order.

# Spring Collets and Feeding Fingers—Continued

	Price, Each
*No. 21A Feeding Fingers, for use with 3-4" Feed Tube:	
Round: 21-32", 11-16", 23-32", and 3-4" .....	\$3.00
Hexagonal: 9-16", 5-8" .....	4.25
Feeding Finger Blanks .....	1.45

## No. 2 Wire Feed (Prior to Machine Serial No. 383)

### No. 12 Spring Collets:

Round: 3-16", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 11-16", 3-4", 13-16", 7-8" .....	6.25
Square: 3-8", 7-16", 1-2", 9-16" .....	8.75
Hexagonal: 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4" .....	8.75
Metric, Round: 10 m/m to 20 m/m, varying by 1-2 m/m .....	6.25
Collet Blanks .....	3.00

### No. 12 Feeding Fingers:

Round: 3-16", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 11-16", 3-4", 13-16", 7-8" .....	3.75
Square: 3-8", 7-16", 1-2", 9-16" .....	4.75
Hexagonal: 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4" .....	4.75
Feeding Finger Blanks .....	1.80

## Nos. 2 and 2G Automatic, also Nos. 2 and 2F Wire Feed (Commencing Machine Serial No. 383)

### No. 22 Spring Collets:

Round: 1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 21-32", 11-16", 23-32", 3-4", 25-32", 13-16", 27-32", 7-8", 29-32", 15-16", 31-32", 1" .....	6.25
Square: 1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16" .....	8.75
Hexagonal: 1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4", 13-16", 7-8" .....	8.75
Metric, Round: 10 m/m to 25 m/m, varying by 1 m/m .....	6.25
Collet Blanks .....	3.00

### No. 22 Feeding Fingers:

Round: 1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 21-32", 11-16", 23-32", 3-4", 25-32", 13-16", 27-32", 7-8", 29-32", 15-16", 31-32", 1" .....	3.75
Square: 1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16" .....	4.75
Hexagonal: 1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4", 13-16", 7-8" .....	4.75
Metric, Round: 10 m/m to 25 m/m, varying by 1 m/m .....	3.75
Feeding Finger Blanks .....	1.80

### No. 22B Spring Collets, for use with 1 1-8" Feed Tube:

Round: 1 1-16", 1 1-8" .....	8.00
Hexagonal: 15-16" .....	12.00
Metric, Round: 26, 27, 28 m/m .....	8.00
Collet Blanks .....	4.75

\*Used only on No. 1 Wire Feed commencing with Machine Serial No. 495.  
List continued on next page. Other sizes made to order.

## Spring Collets and Feeding Fingers—Continued

	Price, Each
<b>No. 22A Feeding Fingers, for 1 1-8" Feed Tube:</b>	
Round: 1 1-16", 1 1-8" .....	\$4.75
Hexagonal: 15-16" .....	8.00
Metric, Round: 26, 27, 28 m/m .....	4.75
Feeding Finger Blanks .....	3.00

### Nos. 2 and 2G Automatic

#### No. 22A Spring Collets, for use with Outside Feeding Attachment, for Machines with 1 5-16" Hole in Spindle:

Round: 1 1-16", 1 1-8", 1 3-16", 1 1-4" .....	8.00
Hexagonal: 1", 1 1-6", 1 1-8" .....	12.00
Collet Blanks .....	4.75

#### No. 22B Spring Collets, for use with Outside Feeding Attachment, for Machines with 1 7-16" Hole in Spindle:

Round: 1 1-16", 1 1-8", 1 3-16", 1 1-4", 1 5-16", 1 3-8" .....	8.00
Hexagonal: 1", 1 1-16", 1 1-8", 1 3-16" .....	12.00
Metric, Round: 26 m/m to 35 m/m, varying by 1 m/m .....	8.00
Collet Blanks .....	4.75

#### No. 22C Feeding Finger, for use with Outside Feeding Attachment:

Round: Takes interchangeable sets of pads for any size round stock from 1 1-16" to 1 3-8", inclusive .....	25.00
Hexagonal: Takes interchangeable sets of pads for any size hexagonal stock from 1" to 1 3-16", inclusive .....	25.00
Square: Takes interchangeable sets of pads for any size square stock from 3-4" to 15-16", inclusive .....	25.00

#### Pads for 22C Feeding Fingers:

Round: From 1 1-6" to 1 3-8", inclusive, by 16ths, set of four ....	8.00
*Hexagonal: From 1" to 1 3-16", inclusive, by 16ths, set of three ..	10.00
*Square: From 3-4" to 15-16", inclusive, by 16ths, set of four ....	10.00
*Metric: Round from 26 m/m to 35 m/m .....	8.00

### No. 4 Automatic Screw Machine

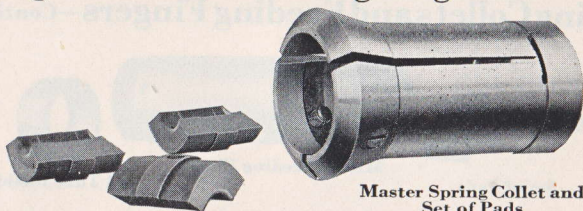
#### No. 24M Master Spring Collets: (Slotted three times for round and hexagonal stock, four times for square stock.)

Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 1 1-2" diameter, and any size hexagonal stock to and including 1 5-16" .....	20.00
Square: Takes interchangeable sets of pads for any size square stock to and including 1 5-16" .....	22.00

\*Made to order.      Other sizes made to order.      List continued on next page.



# Spring Collets and Feeding Fingers—Continued



**Master Spring Collet and  
Set of Pads**

	Price, Each
<b>*Pads for No. 24M Master Spring Collets:</b>	
Round: Any size to and including 1 1-2", set of three.....	\$8.50
Hexagonal: To and including 1 5-16", set of three.....	11.00
Square any size to and including 1 5-16", set of four.....	11.00
<b>No. 24M Master Feeding Fingers:</b> (Slotted three times for round or hexagonal stock, four times for square stock.)	
Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 1 1-4" diameter, and any size hexagonal stock to and including 1 1-16" .....	15.00
Square: Takes interchangeable sets of pads for any size square stock to and including 1 1-16" .....	17.00
<b>*Pads for No. 24M Master Feeding Fingers:</b>	
Round: Any size to and including 1 1-4", set of three.....	6.50
Hexagonal: To and including 1 1-16", set of three.....	8.50
Square: Any size to and including 1 1-16", set of four.....	8.50
<b>*No. 24 Feeding Fingers (Regular Style):</b>	
Round: Any size from 1 5-16" to 1 1-2", inclusive.....	15.00
Hexagonal: Any size from 1 1-8" to 1 5-16", inclusive.....	19.00
<b>*Feed Tube Bushings:</b>	
Used in rear end of feed tube for steadying and supporting the bar. Round bushings used for round, square, or hexagonal stock. In specifying size wanted, add 1-32" to diameter or distance across corners of stock.	
Round: 25-32" to 1 17-32", inclusive, by 16ths .....	4.75
<b>*No. 24 Spring Collets, for use with Outside Feeding Attachment:</b>	
Round: Any size from 1 9-16" to 1 7-8", inclusive .....	19.00
Hexagonal: Any size from 1 3-8" to 1 5-8", inclusive.....	24.00
Square: Use No. 24M Master Spring Collet for square stock.	
<b>No. 24MC Master Feeding Fingers, for use with Outside Feeding Attachment:</b>	
Round: Takes interchangeable sets of pads for any size round stock from 1 9-16" to 1 7-8", inclusive .....	26.00
Hexagonal: Takes interchangeable sets of pads for any size hexagonal stock from 1 3-8" to 1 5-8", inclusive ..	26.00
Square: Takes interchangeable sets of pads for any size square stock from 1 1-8" to 1 5-16", inclusive .....	26.00

\*Made to order only.

List continued on next page.

## Spring Collets and Feeding Fingers—Continued



	Price, Each
<b>*Pads for No. 24MC Master Outside Feeding Fingers:</b>	
Round: From 1 9-16" to 1 7-8", inclusive, set of four .....	\$7.00
Hexagonal: From 1 3-8" to 1 5-8", inclusive, set of four .....	9.00
Square: From 1 1-8" to 1 5-16", inclusive, set of four .....	9.00

### No. 6 Automatic Screw Machine

**No. 26M Master Spring Collets:** (Slotted three times for round and hexagonal stock, four times for square stock.)

Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 2" diameter, and any size hexagonal stock to and including 1 3-4" .....	23.00
Square: Takes interchangeable sets of pads for any size square stock to and including 1 11-16" .....	25.00

#### Pads for No. 26M Master Spring Collets:

Round: 3-4" to and including 2", by 1-16ths, set of three .....	8.50
*Hexagonal: Any size to and including 1 3-4", set of three .....	11.00
*Square: Any size to and including 1 11-16", set of four .....	11.00

**No. 26M Master Feeding Fingers:** (Slotted three times for round and hexagonal stock, four times for square stock.)

Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 1 3-4" diameter, and any size hexagonal stock to and including 1 1-2" .....	17.00
Square: Takes interchangeable sets of pads for any size square stock to and including 1 7-16" .....	19.00

#### Pads for No. 26M Master Feeding Fingers:

Round: 3-4" to and including 1 3-4" by 1-16ths, set of three ....	6.50
*Hexagonal: Any size to and including 1 1-2", set of three .....	8.50
*Square: Any size to and including 1 7-16", set of four .....	8.50

#### No. 26 Feeding Fingers (Regular Style):

Round: Any size from 1 13-16" to 2", inclusive, by 1-16ths ....	17.00
*Hexagonal: Any size from 1 9-16" to 1 3-4", inclusive .....	21.00

\*Made to order only. List continued on next page.



## Spring Collets and Feeding Fingers—Continued

Price,  
Each

### Feed Tube Bushing:

Used in rear end of feed tube for steadying and supporting the bar. Round bushings used for round, square, or hexagonal stock. **In specifying size wanted, add 1-32" to diameter or distance across corners of stock.**

Round: 25-32" to 2 1-32", inclusive, by 1-16ths..... \$5.00

### No. 26 Spring Collets, for use with Outside Feeding Attachment:

Round: Any size from 2 1-16" to 2 3-8", inclusive..... 21.00

\*Hexagonal: Any size from 1 13-16" to 2", inclusive..... 26.00

Square: Use No. 26M Master Spring Collet for square stock.

### No. 26MC Master Feeding Fingers, for use with Outside Feeding Attachment:

Round: Takes interchangeable sets of pads for any size round stock from 2 1-16" to 2 3-8", inclusive..... 30.00

Hexagonal: Takes interchangeable sets of pads for any size hexagonal stock from 1 13-16" to 2", inclusive..... 30.00

Square: Takes interchangeable sets of pads for any size square stock from 1 1-2" to 1 11-16", inclusive..... 30.00

### Pads for No. 26MC Master Feeding Fingers:

Round: Any size from 2 1-16" to 2 3-8", inclusive, by 1-16ths, set of four..... 7.00

\*Hexagonal: Any size from 1 13-16" to 2", inclusive, set of four... 9.00

\*Square: Any size from 1 1-2" to 1 11-16", inclusive, set of four... 9.00

\*Made to order only.

### Extra Capacity Collets

Special Collets or Chucks can be provided for Plain, Wire Feed and Automatic Screw Machines for holding on the spindle work of considerably larger diameter than the rated bar capacity of the machines. They are intended primarily for chucking pieces cut from the bar, pressed work and pieces already partly finished in another machine.

Capacity: No. 0 Wire Feed, 1 3-4" diameter by 3-8" deep; No. 1 Wire Feed, 2 1-2" diameter by 7-16" deep; Nos. 2 and 2F Wire Feed and 2 and 2G Automatic, 3" diameter by 1-2" deep; Nos. 00 and 00G Automatic, 1 3-8" diameter by 1-4" deep; Nos. 0 and 0G Automatic, 2" diameter by 3-8" deep; No. 4 Automatic, 4" diameter by 1-2" deep; No. 6 Automatic, 5" diameter by 5-8" deep; Nos. 4 Plain and 4 Wire Feed, 6" diameter by 9-16" deep; Nos. 6 Plain and 6 Wire Feed, 7" diameter by 5-8" deep.

As these collets are intended only for special work it is necessary for us to have details regarding the work to be done before quoting prices.



## Extra Size Feed Tubes and Fingers

### FOR WIRE FEED AND AUTOMATIC SCREW MACHINES

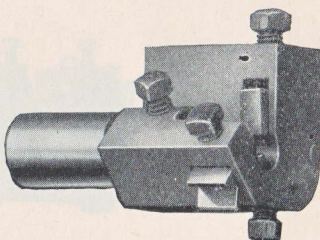
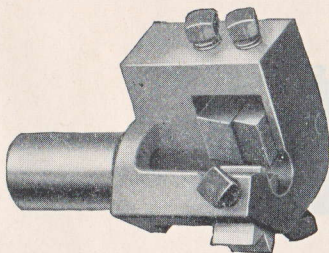
These feed tubes and fingers are somewhat lighter in construction than those regularly furnished with the machines. As they allow stock to be used of larger diameter than the rated capacity of the machines, they are offered for use only on brass or other work requiring comparatively light cuts. Be sure to give serial number of machine.

No. of Mach.	Machine Serial No.	Largest Diameter of Stock, Inches			Fingers, How Attached	Tube without Finger, Price	Tube with Round Finger, Price
		Round	Hex.- Flats	Square			
W. F.							
0	96 to 371	17-32	29-64	3-8	One Piece		\$19.50
	96 to 371	1-2	7-16	23-64	Soldered	\$12.00	15.00
	begin 372	1-2	7-16	23-64	Threaded	16.00	19.50
1	prior to 227	9-16	1-2	13-32	Soldered	12.00	15.00
	prior to 227	5-8	17-32	29-64	One Piece		19.50
	227 to 495	3-4	21-32	35-64	Soldered	13.75	16.75
	begin 496	3-4	21-32	35-64	Threaded	18.50	21.50
2 and 2F	prior to 383	1	7-8	23-32	Soldered	25.50	29.25
	383 to 863	1 1-16	15-16	3-4	Soldered	25.50	29.25
	begin 864	1 1-8	31-32	25-32	Threaded*	35.50	40.25
Auto.							
00	prior to 3448	3-8	21-64	17-64	Soldered	9.75	12.00
00G	prior to 3098						
00	begin 3448	3-8	21-64	17-64	Threaded	9.75	12.00
00G	begin 3098						
0	prior to 2015	9-16	1-2	13-32	Soldered	12.00	15.00
0G	prior to 2215						
0	prior to 2015	5-8	17-32	29-64	One Piece		19.50
0G	prior to 2215						
0	begin 2015	5-8	17-32	29-64	Threaded	12.00	15.00
0G	begin 2215						
1		11-16	39-64	1-2	Soldered	16.00	19.00
1		3-4	21-32	35-64	One Piece		23.00
2	prior to 2255	1 1-16	15-16	3-4	Soldered	25.50	29.25
2G	prior to 2205						
2	begin 2255	1 1-8	31-32	25-32	Threaded*	35.50	40.25
2G	begin 2205						

\*Special chuck nut and chuck sleeve are included with feed tube.

## Box Tools

### STYLE 1



This style of box tool is used for general work, for turning one or two diameters as required. When one diameter is being turned with a tool carrying two blades, the blade in the rear is pushed back out of action.

The back rests are beveled on both ends to increase their capacity, one end being for work of small diameter and the other for large work. Plain V rests only are used on this style.

Nos. 00B, 00C, 00D, and 20C are equipped with one blade; all the others have two blades. One set of blades and back rests are furnished.

Nos. 00C, 20, 20A, 20B, 20C and 22B are arranged to hold a center drill or pointing tool in the shank, clamped in position by a set screw. A center drill is furnished with the No. 00C.

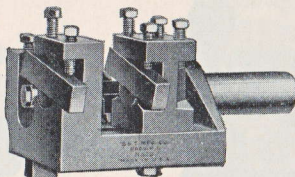
No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00	00, 00G and 19 Auto.	1-4	1 1-4	1 3-8	5-8	1 3-8	\$16.00
‡00A	00, 00G and 19 Auto.	1-4	1 1-4	1 3-8	5-8	1 3-8	19.00
00B	00, 00G and 19 Auto.	3-16	1 1-4	3-4	5-8	1 3-4	8.75
‡00C	00, 00G and 19 Auto.	1-4	5-8	1 3-8	5-8	1 1-8	17.00
‡00D	00, 00G and 19 Auto.	3-16	1 1-4	3-4	5-8	1 3-4	12.00
20	0 and 0G Automatic	1-2	1 5-8	2 3-16	3-4	1 1-2	19.00
‡20A	0 and 0G Automatic	1-2	1 5-8	2 3-16	3-4	1 1-2	23.50
20B	0 and 0G Automatic	1-4	2	2 3-16	3-4	1 1-2	17.75
20C	0 and 0G Automatic	1-2	3-4	1 1-4	3-4	1 1-2	19.00
22B	2 and 2G Automatic	5-8	2	2 5-8	1	2 1-4	27.50

‡With Center Drill.

‡Left Hand.

## Box Tools

### STYLE 2



These tools have roller back rests for the front blades and plain V rests for the rear. The rollers materially reduce the friction on heavy cuts and are adjustable for different diameters. Plain rests are beveled on both ends to increase their range.

The rear tool post is fitted to take blade on either front or back side, or both. It is adjustable along the body of the box tool, allowing for different distances between the front and rear blades.

One set of blades and back rests is furnished.

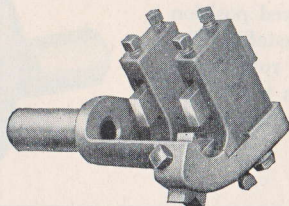
No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
12	2 and 2 F W. F.; 2 Pl.	1	3 1-2	4 3-16	1	2 1-2	\$60.00
14	{ 4 Pl. 428 to 601* 4 W. F. prior to 23* }	1 1-4	4 1-2	5 1-4	1 1-2	3 1-4	75.00
34	{ 4 Pl.; 4 W. F. 5 Plain }	{ 1 1-4 1 1-8 }	{ 4 1-2 8 }	5 1-4	1 3-4	3 1-4	75.00
16	{ 5 Pl. 428 to 581* 6 Pl. 59 to 230* }	1 1-2	5	5 9-16	1 1-2	3 1-4	90.00
36	6 Pl.; 6 W. F.	{ 1 1-2 1 3-8 }	{ 5 10 }	5 9-16	2	3 1-4	90.00

\*Be sure to give serial number of machine.



## Box Tools

### STYLE 3



The front tool holder is fixed in position; the rear tool holder is adjustable along the body of the tool, allowing for different distances between the blades. The holders are made narrow to allow the tools to be set close together when desired. The back rest is beveled on both ends, one end being used for large and one for small diameters. One set of blades is furnished.

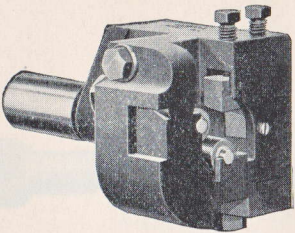
No. 22 Box Tool differs from cut in having three tool holders with back rests, the two rear tool holders being adjustable. It is also arranged to hold a center drill in the shank. The drill is not included in price of tool. One set of blades and back rests is furnished.

No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
20D	0 and 0G Auto.	3-8	2	2 3-16	3-4	1 1-2	\$27.50
21	1 Automatic	1-2	2	2 5-8	1	1 3-4	27.50
22	2 and 2G Auto.	7-8	2 3-8	3	1	2	35.50
10	0 Wire Feed	3-8	1 3-4	2 3-16	5-8	1 7-16	27.50
11	1 W. F.; 1 Plain	1-2	2 1-4	2 11-16	3-4	2	27.50
13		1	3	3 3-4	1 1-4	3 1-4	43.00

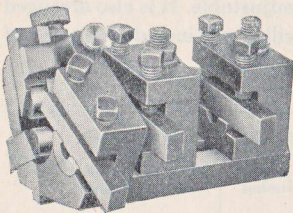
Box Tools

STYLE 4

The blade is in a fixed position and the back rests adjustable. The back rests are of the roller type to reduce friction. This tool is intended for work requiring one cut only.



No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00E	00, 00G and 19 Auto.	1-4	1 1-4	1 7-16	5-8	1 3-8	\$34.00
10E	0 Wire Feed	3-8	1 3-4	2 3-16	5-8	1 7-16	43.00
11E	1 Wire Feed	1-2	2 1-4	2 11-16	3-4	2	52.00
20E	0 and 0G Auto.	1-2	1 5-8	2 3-16	3-4	1 1-2	43.00
22E	2 and 2G Auto.	7-8	2 3-8	3	1	2	52.00

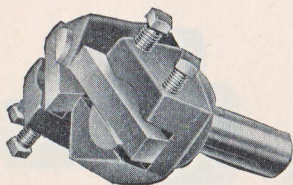


These tools have blades providing means for turning as many as three diameters at once when required. Two of the blades are sometimes used for turning and the third for pointing. The two rear tool holders are adjustable along the tool body and may be reversed.

The work is supported by a roller back rest opposite the front blade, and a plain V rest between the rear blades.

No.	No. of Machine where used	Turning Capacity Diameter, Inches	Price
24	4 Automatic	3-8 to 1 1-2	\$90.00
26	6 Automatic	1-2 to 1 3-4	100.00

## Balance Turning Tools

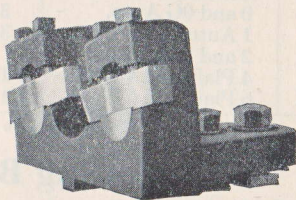


These tools are intended for roughing cut only with one blade set to remove one-half the chip, the opposite blade set to the roughing size and ground slightly behind the other. Tools are fitted with high-speed steel blades.

No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
*00A	00, 00G and 19 Auto.	11-32	1 1-4	1	5-8	1 3-8	\$24.00
00B	00, 00G and 19 Auto.	11-32	1 1-4	1	5-8	1 3-8	24.00
10	0 Wire Feed	3-8	2	2 3-16	5-8	1 7-16	25.00
11	1 W. F.; 1 Plain	5-8	2 1-2	2 3-4	3-4	2	29.00
12	2 and 2F W.F.; 2 Pln.	1	3 5-8	4 1-8	1	2 1-2	34.00
20	0 and 0G Auto.	5-8	2	2 3-16	3-4	1 3-4	28.00
20B	0 and 0G Auto.	11-32	2	2 1-4	3-4	1 3-4	24.00
22	2 and 2G Auto.	1	2 5-8	3	1	1 3-4	32.00
34	4 W. F.; 4 Plain	{ 1 1-2 15-16	{ 4 3-4 8	5 1-4	1 3-4	3 1-4	38.00

\*Left hand.

The No. 36 Balance Turning Tool differs from the one shown in cut in that it screws on the face of the turret.

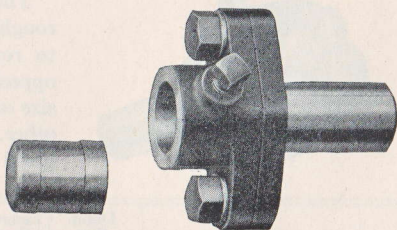


No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Method of Attaching	Price
24	No. 4 Auto.	1 1-2	4	Clamps on face of turret	\$34.00
26	No. 6 Auto.	2	5	Clamps on face of turret	38.00
36	6 W. F.; 6 Plain	1 15-16	10	Screws on face of turret	42.00



## Floating Holders

For holding drills, reamers, counterbores, etc., in the turret. Tools are set to the proper length and clamped by set screw. The holder and shank are separate and, after the tool is adjusted concentric with the work, the two are clamped together. One blank bushing is furnished. Bushings listed, page 365.



No.	No. of Machine where used	Diam. of Hole for Drill or Bushing, Inches	Depth of Hole, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00	00, 00G and 19 Auto.	5 Taper	5-8	15-16	5-8	1 1-8	\$6.25
00A	00, 00G and 19 Auto.	1-2	11-16	27-32	5-8	1 1-8	6.25
10	0 Wire Feed	1-2	11-16	29-32	5-8	1 7-16	6.25
11	1 W. F. and 1 Plain	5-8	13-16	1 1-8	3-4	2	7.00
12	2 & 2F W.F. and 2 Pl.	1	1 3-16	1 1-2	1	2 1-2	8.00
14	{ 4 Plain 428 to 601*	1	1 3-16	1 9-16	1 1-2	3 1-4	8.75
16	{ 4 W. F. prior to 23*	1 1-2	1 5-8	2 5-32	1 1-2	3 1-4	12.00
	{ 5 Plain 428 to 581*						
	{ 6 Plain 59 to 230*						
20	0 and 0G Auto.	5-8	13-16	1 1-8	3-4	2	7.00
21	1 Auto.	3-4	15-16	1 1-4	1	2 1-2	9.75
22	2 and 2G Auto.	1	1 3-16	1 1-2	1	1 3-4	8.00
34	4 Plain and 4 W. F.	1 1-2	1 5-8	2 5-32	1 3-4	3	12.00
36	6 Plain and 6 W. F.	1 1-2	1 5-8	2 5-32	2	3 1-4	12.00

\*Be sure to give serial number of machine.

## Slotting Bushing Blanks

The bushing blanks are for use in the transporting arm of the various attachments, for carrying the piece of work from the spindle to the attachment. The blanks are finished to fit the transporting arm, so that it is only necessary to recess to hold the piece of work and slot for the ejector.

For use with Nos. 00 and 00G Automatic Screw Machines.....\$0.45

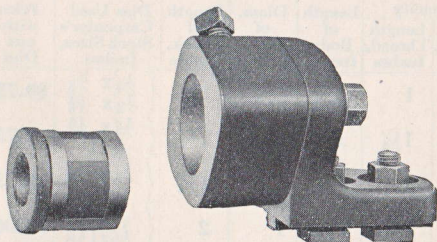
For use with Nos. 0 and 0G Automatic Screw Machines..... 0.45

For use with Nos. 2 and 2G Automatic Screw Machines..... 0.55

## Floating Holders

These Floating Holders hold drills, reamers, etc., which can be set central with work, after which the floating head is clamped. One bushing blank is furnished.

Bushings listed, page 365.



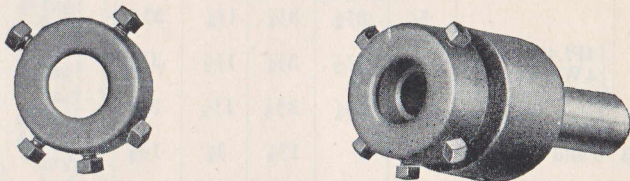
No.	No. of Machine where used	Diam. of Hole for Bushing, Inches	Price of Holder	Price of Bushing Blanks
24	4 Automatic	1 3-4	\$22.00	\$1.25
26	6 Automatic	2	22.00	1.25

## Floating Holder Extensions

For use with Nos. 24 and 26 Floating Holders

24	4 Automatic	1 1-4	\$10.00
26	6 Automatic	1 1-2	14.00

## Die Holders



### Plain Draw-out Style

Die Holders are of two styles, either with or without a releasing arrangement. The holders without releasing arrangement are of the plain, draw-out type. The releasing type is of special advantage on hand operated machines, being provided with an improved clutch mechanism which allows the holder to be released without shock. The construction is simple and parts subject to wear are hardened.

See Lists on next page.

## Die Holders — Non-Releasing Style

No. of Holder	No. of Machine where used	Capacity		Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Dies Used Carpenter's Stock Sizes, Inches	Price without Dies
		Diam. Thread, Inches	Length Thread, Inches					
00E	00 & 00G Auto.	$\frac{5}{16}$	1	$1\frac{3}{8}$	$\frac{5}{8}$	$1\frac{1}{4}$	$\left\{ \begin{array}{l} \frac{1}{4} \times \frac{5}{8} \\ \frac{1}{4} \times \frac{13}{16} \end{array} \right.$	\$9.75
*20	0 & 0G Auto.	$\frac{3}{8}$	$1\frac{1}{4}$	$1\frac{3}{4}$	$\frac{3}{4}$	$1\frac{3}{4}$	$\left\{ \begin{array}{l} \frac{1}{4} \times \frac{13}{16} \\ \frac{5}{16} \times 1 \end{array} \right.$	9.75
21	1 Auto.	$\frac{3}{8}$	2	$2\frac{5}{8}$	1	$1\frac{3}{4}$	$\left\{ \begin{array}{l} \frac{1}{4} \times \frac{13}{16} \\ \frac{5}{16} \times 1 \end{array} \right.$	13.75
*22	2 & 2 G Auto.	$\frac{1}{2}$	$1\frac{3}{4}$	$2\frac{3}{8}$	1	2	$\left\{ \begin{array}{l} \frac{5}{16} \times 1 \\ \frac{1}{2} \times 1\frac{1}{2} \end{array} \right.$	12.00

\*Extra capacity die caps and bushings can be furnished to take larger dies on these holders: for No. 20, takes a die 1-2" x 1 1-2"—\$5.00; for No. 22, takes a die 5-8" x 2"—\$6.00.

## Releasing Style

No.	No. of Machine where used	Capacity		Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Dies Used Carpenter's Stock Sizes, Inches	Price without Dies
		Diam. Thread, Inches	Length Thread, Inches					
†00B	00 & 00G Auto.	$\frac{1}{4}$	$\frac{3}{4}$	$1\frac{7}{16}$	$\frac{5}{8}$	$1\frac{1}{8}$	$\left\{ \begin{array}{l} \frac{1}{4} \times \frac{5}{8} \\ \frac{1}{4} \times \frac{5}{8} \end{array} \right.$	\$9.75
10	0 Wire Feed	$\frac{9}{32}$	1	$1\frac{11}{16}$	$\frac{5}{8}$	$1\frac{7}{16}$	$\left\{ \begin{array}{l} \frac{1}{4} \times \frac{5}{8} \\ \frac{1}{4} \times \frac{13}{16} \end{array} \right.$	9.75
†11	1 W. F.; 1 Plain	$\frac{3}{8}$	1	$1\frac{7}{8}$	$\frac{3}{4}$	2	$\left\{ \begin{array}{l} \frac{1}{4} \times \frac{13}{16} \\ \frac{5}{16} \times 1 \end{array} \right.$	12.00
†12	2 and 2FW. F.; 2 Plain	$\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{3}{8}$	1	$2\frac{1}{2}$	$\left\{ \begin{array}{l} \frac{5}{16} \times 1 \\ \frac{1}{2} \times 1\frac{1}{2} \end{array} \right.$	16.00
13		$\frac{3}{4}$	$2\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{1}{4}$	$3\frac{1}{4}$	$\left\{ \begin{array}{l} \frac{1}{2} \times 1\frac{1}{2} \\ \frac{5}{8} \times 2 \end{array} \right.$	29.50
14	$\left\{ \begin{array}{l} 4\text{Pl. 428 to 601}^* \\ 4\text{WFp'r to 23}^* \end{array} \right.$	$\frac{3}{4}$	$2\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{1}{2}$	$3\frac{1}{4}$	$\left\{ \begin{array}{l} \frac{1}{2} \times 1\frac{1}{2} \\ \frac{5}{8} \times 2 \end{array} \right.$	31.00
16	$\left\{ \begin{array}{l} 5\text{Pl. 428 to 581}^* \\ 6\text{Pl. 59 to 230}^* \end{array} \right.$	$1\frac{1}{16}$	$2\frac{3}{4}$	$3\frac{5}{8}$	$1\frac{1}{2}$	$3\frac{1}{4}$	$\left\{ \begin{array}{l} \frac{5}{8} \times 2 \\ \frac{11}{16} \times 2\frac{1}{2} \end{array} \right.$	39.00
†20B	0 and 0G Auto.	$\frac{3}{8}$	1	$1\frac{7}{8}$	$\frac{3}{4}$	$1\frac{1}{2}$	$\left\{ \begin{array}{l} \frac{1}{4} \times \frac{13}{16} \\ \frac{5}{16} \times 1 \end{array} \right.$	12.00
†22B	2 and 2G Auto.	$\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{3}{8}$	1	2	$\left\{ \begin{array}{l} \frac{5}{16} \times 1 \\ \frac{1}{2} \times 1\frac{1}{2} \end{array} \right.$	16.00
34	4 & 5 Pl.; 4 W. F.	$\left\{ \begin{array}{l} 1 \\ \frac{13}{16} \end{array} \right.$	$\left\{ \begin{array}{l} 2\frac{3}{4} \\ 8 \end{array} \right.$	$3\frac{5}{8}$	$1\frac{3}{4}$	3	$\left\{ \begin{array}{l} \frac{5}{8} \times 2 \\ \frac{11}{16} \times 2\frac{1}{2} \end{array} \right.$	39.00
36	6 Plain; 6 W. F.	$\left\{ \begin{array}{l} 1\frac{1}{2} \\ 1\frac{1}{16} \end{array} \right.$	$\left\{ \begin{array}{l} 3\frac{1}{8} \\ 10 \end{array} \right.$	4	2	$3\frac{1}{4}$	$\left\{ \begin{array}{l} \frac{5}{8} \times 2 \\ \frac{11}{16} \times 2\frac{1}{2} \\ 1\frac{1}{16} \times 3 \end{array} \right.$	50.00

\*Be sure to give serial number of machine.

†Extra capacity die caps and bushings can be furnished to take larger dies on following holders: For Nos. 00B, takes die 1-4" x 13-16"—\$2.50. For Nos. 11 and 20B, takes die 1-2" x 1 1-2"—\$5.00; for Nos. 12 and 22B, takes die 5-8" x 2"—\$6.00.



## Tap Holders

Tap Holders are of two styles, either with or without a releasing arrangement. The holders without releasing arrangement are of the plain, draw-out type. The releasing style is adapted to hand operated machines being reversed without shock. This holder can be changed from right to left-hand thread cutting by shifting the balls in to the opposite pockets. All parts are hardened. One blank bushing furnished. Bushings listed, page 365.



Plain Draw-out Style

### Non-Releasing Style

No. of Holder	No. of Machine where used	Diameter of Hole for Tap or Bushing, Inches	Depth of Hole, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00	00 and 00G Auto.	No. 5 Taper	5-8	15-16	5-8	1 1-8	\$8.00
00A	00 and 00G Auto.	1-4	3-8	15-16	5-8	1 1-8	7.50
00C	00 and 00G Auto.	1-2	11-16	15-16	5-8	1 1-8	8.00
20	0 and 0G Auto.	5-8	13-16	1 7-16	3-4	1 1-2	8.75
21	1 Auto.	3-4	15-16	1 1-2	1	1 3-4	9.75
22	2 and 2 G Auto.	1	1 3-16	1 9-16	1	2	9.75

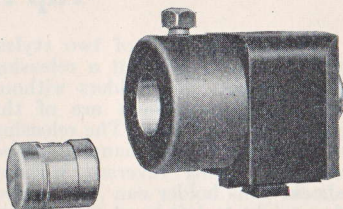
### Releasing Style

No. of Holder	No. of Machine where used	Diam. of Hole, Inches	Depth of Hole, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00B	00 and 00G Auto.	1-2	1-2	1 1-16	5-8	1 1-8	\$9.50
10	0 Wire Feed	1-2	11-16	1 5-16	5-8	1 7-16	9.75
11	1 Wire Feed; 1 Plain	5-8	13-16	1 7-16	3-4	2	10.75
12	2 & 2 F Wire Feed; 2 Pl.	1	1 3-16	2	1	2 1-2	13.75
13		1	1 3-16	2 1-2	1 1-4	3 1-4	28.00
14	4 Plain 428 to 601*						
	4 W. F. prior to 23*	1	1 3-16	2 1-2	1 1-2	3 1-4	28.00
16	5 Plain 428 to 581*	1 1-2	1 5-8	2 7-8	1 1-2	3 1-4	32.00
	6 Plain 59 to 230*						
20B	0 and 0G Auto.	5-8	13-16	1 7-16	3-4	1 1-2	10.75
22B	2 and 2G Auto.	1	1 3-16	2	1	2	13.75
34	4 Plain; 4 Wire Feed	1 1-2	1 5-8	2 7-16	1 3-4	3	30.00
36	6 Plain; 6 Wire Feed	1 1-2	1 5-8	2 7-8	2	3 1-4	35.00

\*Be sure to give serial number of machine.

## Tap Holders

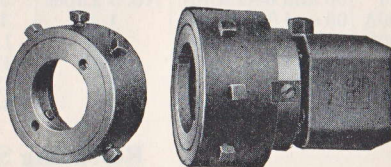
These tap holders are of the plain, draw-out type, the tap being held directly in the holder or in a bushing. One blank bushing, as shown in cut, is furnished. Bushings listed, page 365.



No.	No. of Machine where used	Size of Hole for Tap or Bushing, Inches	Price of Tap Holder	Price, Fin. Bushings	Price of Blanks
24	4 Automatic	{ 1 1-4 diameter 1 1-2 deep }	\$35.00	\$3.00	\$0.85
26	6 Automatic	{ 1 1-2 diameter 1 5-8 deep }	45.00	3.00	.85

## Die Holders

These die holders are of the plain, draw-out type. Two caps are furnished with the No. 24 having inside diameters of 2" and 2 1-2", and with the No. 26, three caps are furnished having inside diameters of 2", 2 1-2" and 3".



No.	No. of Machine where used	Threading Capacity, Inches	Price
24	4 Automatic	To 1 3-16 diam.	\$38.00
26	6 Automatic	To 1 7-16 diam.	38.00

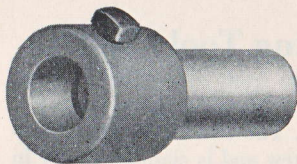
Stock sizes of Carpenters' dies used:

For No. 24—1-2" x 1 1-2", 5-8" x 2", and 11-16" x 2 1-2".

For No. 26—5-8" x 2", 11-16" x 2 1-2", and 1 1-16" x 3".

## Opening Die Holders

The use of these Die Holders obviates the necessity of reversing the spindle to back the die off threaded work. They are especially useful for threading operations when only one spindle is available for driving, or on machines not arranged to reverse. All sizes of these Die Holders carry four chasers.



## Drill Holders

Drills are held directly in holder or in a bushing. One blank bushing furnished with each holder. Bushings listed below.

No.	No. of Machine where used	Diam. of Hole for Drill or Bushing, Inches	Depth of Hole, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00	00 and 00G Auto.	5 Taper	5-8	7-8	5-8	1 1-8	\$4.00
00A	00 and 00G Auto.	1-2	11-16	7-8	5-8	1 1-8	4.00
10	0 Wire Feed	1-2	11-16	1	5-8	1 7-16	4.00
11	1 W. F. and 1 Plain	5-8	13-16	1 1-8	3-4	2	4.00
12	2 & 2F W.F. & 2 Plain	1	1 3-16	1 5-8	1	2 1-2	6.25
14	{ 4 Plain 428 to 601* }	1	1 3-16	1 7-8	1 1-2	3 1-4	7.00
16	{ 5 Plain 428 to 581* }	1 1-2	1 5-8	2 1-4	1 1-2	3 1-4	8.00
	{ 6 Plain 59 to 230* }						
20	0 and 0G Auto.	5-8	13-16	1	3-4	1 15-16	4.00
21	1 Automatic	3-4	15-16	1 1-4	1	1 3-4	4.75
22	2 and 2G Auto.	1	1 3-16	1 7-16	1	1 3-4	6.25
34	4 Plain and 4 W. F.	1 1-2	1 5-8	2 1-4	1 3-4	3	8.00
36	6 Plain and 6 W. F.	1 1-2	1 5-8	2 1-4	2	3 1-4	8.00

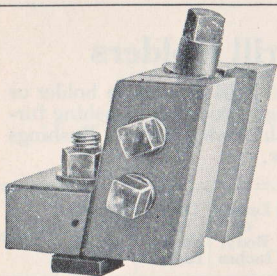
\*Be sure to give serial number of machine.

## Bushings and Bushing Blanks

These Bushings are used for holding drills, taps, reamers, etc., in Drill Holders, Tap Holders, or Floating Holders. The tool is clamped securely in the bushing when the set screw in the holder bears upon the flat on the bushing shoe. The Bushing Blanks are turned to size and are provided with a shoe for clamping the tool.

No.	No. of Drill, Tap or Floating Holders where used	Outside Diameter, Inches	Length, Inches	Finished Bushing, Price	Bushing Blank, Price
00	00	5 Taper	11-16	\$2.20	\$0.55
00A	00A Tap Holder	1-4	7-16	2.20	.55
10	00A, 00C, 10	1-2	3-4	2.20	.55
00B	00B	1-2	9-16	2.20	.55
11	11, 20, 20B	5-8	7-8	2.20	.55
21	21	3-4	1	2.20	.65
12	12, 13, 14, 22, 22B	1	1 1-4	2.20	.65
16	{ 16, 34, 36, 26 Tap Holder }	1 1-2	1 3-4	3.00	.85
	{ 26 Float. Holder, Ext. }				
26	26 Floating Holder	2	1 7-8	3.25	1.25





## Forming Tool Holders

Used on the front cross slide of Plain and Wire Feed Screw Machines for heavy forming cuts. The tool is adjusted vertically by a screw and is clamped firmly in position after adjustment by the two cap screws on the side of the holder.

No.	No. of Machine where used	Width of Tool, Inches	Thickness of Tool, Inches	Price
10-A	No. 0 Wire Feed	1	1-2	\$22.00
10-B	No. 0 Wire Feed	1 1-4	9-16	22.00
11-B	No. 1 W. F.; 1 Plain	1 1-4	9-16	30.00
11-C	No. 1 W. F.; 1 Plain	1 3-4	9-16	30.00
12-C	{ No. 2 and 2F W.F.; 2 Plain No. 4 Plain prior to 602* No. 4 W. F. prior to 23* No. 5 Plain prior to 553* }	1 3-4	25-32	35.00
12-E		2 3-4	3-4	40.00
16-D		2 1-2	1	45.00
16-F	No. 6 Plain 59 to 231*	4	1	60.00
34-E	No. 4 Plain and 4 W. F.	2 3-4	1 1-4	50.00
36-F	No. 6 Plain and 6 W. F.	4	1 1-2	60.00

\*Be sure to give serial number of machine.

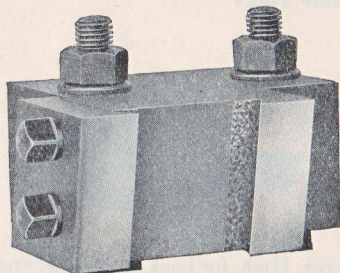
## Forming Tool Blanks

The tool blanks are dovetailed to fit the holder and when required have a series of slots milled in the back to receive the collar of the adjusting screw.

No.	Width, Inches	Thickness, Inches	Length, Inches	Carbon Steel, Price
10-A	1	1-2	1 1-2	\$3.50
10-B	1 1-4	9-16	1 1-2	4.00
11-B	1 1-4	9-16	2	4.00
11-C	1 3-4	9-16	2	5.00
12-C	1 3-4	25-32	2 7-16	5.00
12-E	2 3-4	3-4	2 7-16	6.75
16-D	2 1-2	1	2 7-8	8.00
16-F	4	1	2 7-8	13.50
†34-E	2 3-4	1 1-4	2 7-16	6.25
	2 3-4	1 1-4	2 7-8	6.25
36-F	4	1 1-2	3 5-16	10.75

†Specify length wanted when ordering. For machines 3 1-2" from center of spindle to top of cross slide use 2 7-16" length; for machines 3 15-16" from center of spindle to top of cross slide use 2 7-8" length.

## Forming Tool Holders



These forming tool holders are held on the front cross slide of the machine and are used on heavy forming operations. Dove-tailed tool blanks for this holder are made to order.

No.	No. of Machine where used	Takes Tools, Inches	Price
24	4 Automatic	2 3-4 wide	\$45.00
26	6 Automatic	4 wide	50.00

## Circular Cutting-Off and Forming Tool Blanks

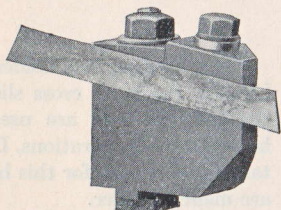
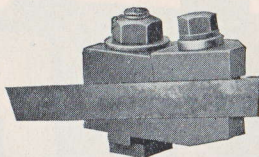
Blanks for Cutting-Off and Forming Tools are made of either Carbon or High Speed Steel. They are turned to size, drilled and tapped for clamping screw. Specify thickness when ordering.

No. of Machine where used	Diam., Inches	Thickness, Inches	Carbon Steel, Price	High Speed Steel, Price
00, 00G and 19 Auto.	1 3-4	1-4 to 1-2 by 16ths	\$0.90	Prices on Application
00, 00G and 19 Auto.	1 3-4	9-16 to 1 by 16ths	1.25	
0 and 0G Automatic	2 1-4	5-16 to 5-8 by 16ths	1.25	
0 and 0G Automatic	2 1-4	11-16 to 1 1-8 by 16ths	1.75	
1 Automatic	2 1-2	3-8 to 7-8 by 16ths	2.00	
1 Automatic	2 1-2	15-16 to 1 1-4 by 16ths	3.00	
2 and 2G Automatic	3	3-8 to 13-16 by 16ths	2.00	
2 and 2G Automatic	3	7-8 to 1 1-4 by 16ths	3.00	
*4 Automatic	3 1-2	1-2, 5-8, 3-4, 7-8	5.60	
*4 Automatic	3 1-2	1, 1 1-4, 1 1-2	6.75	
*4 Automatic	3 1-2	1 3-4, 2	8.50	
*6 Automatic	4	1-2, 5-8, 3-4, 7-8	6.25	
*6 Automatic	4	1, 1 1-4, 1 1-2	7.25	
*6 Automatic	4	1 3-4, 2	9.25	
*6 Automatic	4	2 1-4, 2 1-2	12.00	
*6 Automatic	4	2 3-4	13.75	

\*Made to order only.

## Cutting-Off Tool Posts

### For Thin Blade Tools

**High Back****Low Front**

One blade is furnished with each post. High, for back cross slide, and low, for front cross slide, are used when spindle runs forward. Low for back cross slide is used when spindle runs backward.

No.	Style	No. of Machine where used	Top of Cross Slide to Center of Spindle, Inches	Price
00	High back, low back, low front	00 and 00G Auto.	1	\$8.00
10	High back	0 Wire Feed	1 9-16	10.75
11	High back	1 W. F. and 1 Plain	2 1-16	12.00
12	High back	{ 2 and 2F W. F. and 2 Plain	2 1-2	13.00
		{ 4 W. F. prior to 23*		
		{ 4 Pl. prior to 602*		
		{ 5 Pl. prior to 553*		
16	High back	6 Plain 8 to 230*	2 15-16	13.75
20	High back, low back, low front	0 and 0G Auto.	1 5-16	9.75
21	High back and low back	1 Auto.	1 7-16	13.75
22	High back, low back, low front	2 and 2G Auto.	1 7-16	13.75

\*Be sure to give serial number of machine.

## Blades

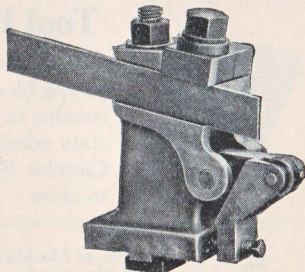
### For Cutting-Off Tool Posts

For Post No.	Thickness, Inches	Width, Inches	Carbon Steel, Price
00	1-32, 1-16, 5-64, 3-32	1-2	\$0.65
10	1-16, 3-32, 1-8	11-16	.65
11, 12, and 16	{ 1-16, 3-32, 1-8	13-16	.55
	{ 5-32		.60
	{ 3-16		.65
20, 21, and 22	1-16, 3-32, 1-8	11-16	.65
For No. 4 Auto.	3-16	13-16	.65
For No. 6 Auto.	3-16	1	.80



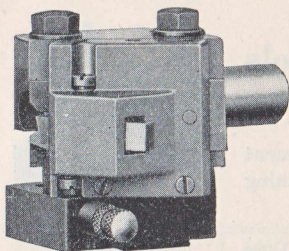
## Combination Cutting-Off and Knurling Tool Posts

These posts are used on the back cross slide of Plain and Wire Feed Screw Machines for cross knurling and cutting off. The knurl passes under the work and the spindle must be running forward. One blade and straight knurl are furnished. For blades see list, page 368.



No.	No. of Machine where used	Top of Cross Slide to Center of Spindle, Inches	Price
10	No. 0 Wire Feed	1 9-16	\$30.00
11	No. 1 Wire Feed	2 1-16	35.00
12	{ No. 2 and 2F W. F. and 2 Plain } { No. 4 Pl. prior to 602* } { No. 5 Pl. prior to 553* }	2 1-2	40.00

\*Be sure to give serial number of machine.

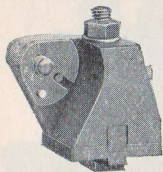


## Angular Cutting-Off Tools

The Angular Cutting-Off Tool is held in the turret and operated by a Fixed or Adjustable Guide on the front cross slide. It is used when it is desired to form the end of the work coneshaped and to produce a clean-cut sharp point when cut off. It is adjustable for any included angle within its capacity.

No.	No. of Machine where used	Total Inc. Angle	Diameter Shank, Inches	Length Shank, Inches	Length Body, Inches	Price
00	00, 00G, 19	50° to 30°	5-8	1 1-8	2 1-8	\$80.00
20	0 and 0G	50° to 30°	3-4	1 3-8	2 5-8	115.00
22	2 and 2G	50° to 30°	1	1 3-4	3 5-16	150.00

Price does not include Fixed or Adjustable Guide.



## Tool Posts for Circular Tools

They are provided with tool adjustment, also a raising block so they may be used with the spindle running in either direction. In ordering, be sure to state whether to be used on front or back slide. Circular Form Tool Blanks for these posts made to order.

No.	No. of Machine where used	Max'm Diameter, Inches	Max'm Width, Inches	Top of Cross Slide to Center of Spindle, Inches	Price, Each
{ 10 Front 10 Back 11 Front 11 Back	0 Wire Feed	1 3-4	3-4	1 9-16	\$24.00
{ 12 Front 12 Back	1 Wire Feed	2 1-4	1 1-4	2 1-16	26.00
{ 12 Front 12 Back	{ 2 and 2FW.F. and 2 Plain 4 Plain prior to 602* 5 Plain prior to 553* }	3	1 3-4	2 1-2	27.50
** { 34 Front 34 Back 36 Front	4 Plain and 4 Wire Feed	4	2	3 15-16	85.00
** { 36 Back	6 Plain and 6 Wire Feed	4	2 1-2	4 7-16	90.00

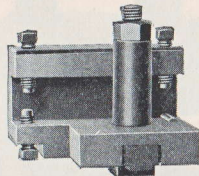
\*Be sure to give serial number of machine.

\*\*Has worm adjustment.

## Tool Posts for Square Tools

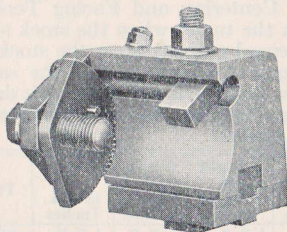
For holding square tools on Automatic Screw Machines.

Means are provided for vertical adjustment of the tool. Cuts only when spindle is running one way.



No.	No. of Machine where used	Top of Cross Slide to Center of Spindle, Inches	Size of Tools		Price, Each
			Height, Inches	Width, Inches	
{ 00 Front 00 Back 20 Front 20 Back	00, 00G and 19 Auto.	1	5-16	7-16	\$18.00
{ 22 Front 22 Back	0 and 0G Automatic	1 5-16	1-2	5-8	23.50
{ 22 Front 22 Back	2 and 2G Automatic	1 7-16	5-8	7-8	31.50
{ 22 Front 22 Back	2 and 2G Automatic	1 7-16	5-8	1-2	31.50

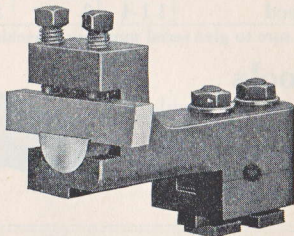
## Tool Posts with Worm Adjustment



These Tool Posts are employed for holding an extra wide circular form tool on Automatic Screw Machines. The tool is adjusted and positively locked in position by a worm and sector. In addition, a hook bolt clamps the tool. The raising block furnished allows the post to be used with the spindle running in either direction. Tool blanks made to order.

No.	Number of Machine where used	Maximum Width of Tool, Inches	Maximum Diameter of Tool, Inches	Center of Spindle to Top of Cross Slide, Inches	Price
20 Front	0 and 0G Automatic	1 3-4	2 1-4	1 5-16	\$58.00
22 Front	2 and 2G Automatic	2 1-4	3	1 7-16	58.00

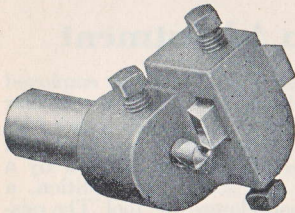
## Turret Tool Posts



Nos. 24A and 26A Turret Tool Posts (short style) and Nos. 24B and 26B Turret Tool Posts (long style) are used either together or singly for turning operations. The raising block with each allows post to be used with spindle running in either direction. They will turn to capacity of machine. Other tools can often be used at same time in advance or in rear of these posts.

No.	No. of Machine where used	Price
24A } 24B } 26A } 26B }	4 Automatic	{ \$22.00 32.00 22.00 32.00
	6 Automatic	





## Centering and Facing Tools

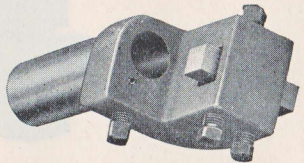
The Centering and Facing Tool is used in the turret when the stock stop is dispensed with. It faces the stock to the required length and at the same time centers it to insure concentric drilling. One turning blade and centering tool furnished.

No.	No. of Machine where used	Diam. of Drill, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00	00, 00G and 19 Auto.	1-4	1 3-8	5-8	1 3-8	\$8.00
10	0 Wire Feed	5-16	1 9-16	5-8	1 7-16	9.75
11	{ 1 Wire Feed; 1 Plain 0 and 0G Auto.	3-8	1 11-16	3-4	2	9.75
14	{ 4 Plain 428 to 601* 4 W. F. prior to 23* 5 Plain 428 to 581* 6 Plain 59 to 231*	7-8	2 3-4	1 1-2	3 1-4	23.50
22	{ 2 and 2F Wire Feed; 2 Plain 1, 2 and 2G Auto.	5-8	1 3-4	1	2 3-4	16.00
34	4 Plain; 4 Wire Feed	7-8	2 3-4	1 3-4	3	23.50
36	6 Plain; 6 Wire Feed	1 1-4	3	2	3 1-4	30.00

\*Be sure to give serial number of machine.

## Knee Tools

Knee Tools are used for simultaneous turning and internal cutting. The shank is arranged to hold a drill, counterbore or similar tool clamped by set screw. One tool blade is furnished.

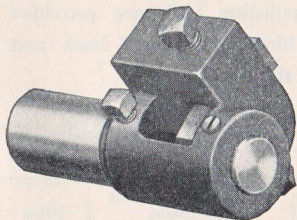


No.	No. of Machine where used	Capacity		Diam. of Shank, Inches	Length of Shank, Inches	Length of Body, Inches	Price
		Length, Inches	Diameter, Inches				
00	00, 00G and 19 Auto.	1 1-4	3-8	5-8	1 1-8	1 3-8	\$16.00
20	0 and 0G Automatic	{ 2 1	{ 15-32 13-16	3-4	1 1-2	2 1-4	19.50
22	2 and 2G Automatic	{ 3 1 11-16	{ 21-32 1 7-16	1	2	3	23.50
34	4 Pl. and 4 Wire Feed	{ 8 2 1-2	{ 1 3-16 1 1-2	1 3-4	3	4 7-8	53.00
36	6 Pl. and 6 Wire Feed	{ 10 4 5-8	{ 1 7-8 2	*	*	5	40.00

\*Screwed to face of turret.

## Pointing Tools

### STYLE 1



Pointing Tools of all styles are provided with a bushing or a plain V rest which precedes the blade to support the work. The blade is adjustable.

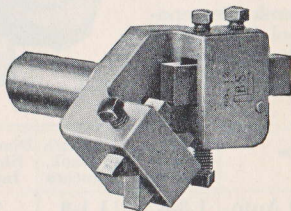
Style 1 is provided with 1 blade and blank bushing.

Nos. 00C, 20B, and 22B are arranged to hold a center drill or pointing tool in the shank, clamped in position by a set screw.

No.	No. of Machine where used	Capacity, Inches	Length of Body, Inches	Dist. Front of Bushing to Tool, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00B	00, 00G, 19 Auto.	3-16	11-16	3-16	5-8	1 13-16	\$9.75
00C	00, 00G, 19 Auto.	1-4	1 3-16	5-16	5-8	1 5-16	10.75
†00D	00, 00G, 19 Auto.	3-16	11-16	3-16	5-8	1 13-16	16.00
20B	0 and 0G Auto.	1-2	1 1-2	3-8	3-4	1 3-4	17.50
22B	2 and 2G Auto.	7-8	1 7-8	1-2	1	2 1-2	23.50

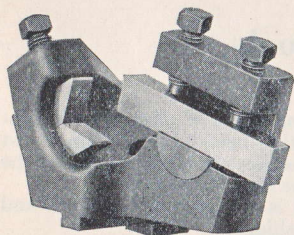
†Left Hand.

### STYLE 2



This style of Pointing Tool is provided with one blade and back rest.

No.	No. of Machine where used	Capacity	Length of Body, Inches	Dist. Front of Rest to Tool, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
12	2 & 2 F W. F.; 2 Pl.	1-4 to 3-4	1 13-16	3-8	1	2 1-2	\$23.50
34	4 Pl.; 4 W. F.	1-4 to 1 1-4	2 3-4	1-2	1 3-4	3	34.00
36	6 Pl.; 6 W. F.	1-2 to 1 1-2	2 15-16	5-8	2	3 1-4	43.00



## Pointing Tools

These pointing tools are provided with one blade, and one V back rest preceding the tool.

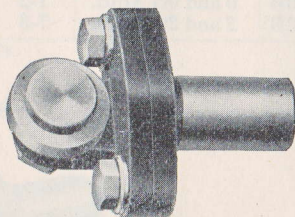
No.	No. of Machine where used	Points Work, Inches	From Back Rest to Tool Blade, Inches	Price
24	4 Automatic	To 1 1-2 diam.	9-16	\$46.00
26	6 Automatic	To 1 1-2 diam.	9-16	49.00

## Pointing Tool Holders

### For Circular Tools

For use in the turret of Automatic Screw Machines for pointing or forming the end of the work. The circular tool may be readily removed and ground without changing its form.

The holder and shank are separate and, after the tool is adjusted central with the work, the two are clamped together. One tool blank is furnished with holder.



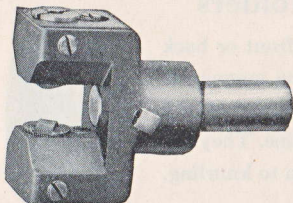
No.	No. of Machine where used	Length Body, Inches	Length Shank, Inches	Diameter Shank, Inches	Diameter Tool Bl'k, Inches	Price
00A	00, 00G and 19 Auto.	1 3-8	1 1-8	5-8	1 1-8	\$16.00
20A	0 and 0G Auto.	1 9-16	1 11-16	3-4	1 3-8	19.50
22A	2 and 2G Auto.	1 15-16	1 3-4	1	1 3-4	27.00

## Circular Pointing Tool Blanks

For use with the Holder shown above. Carbon Steel. Price of blanks for use on Nos. 00, 00G and 19 Automatic, \$0.55; for use on Nos. 0 and 0G Automatic, \$0.55; for use on Nos. 2 and 2G Automatic, \$0.75.



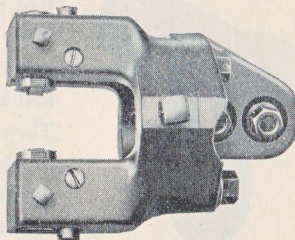
## Adjustable Knurl Holders



The knurls are mounted in swiveling holders adjustable to any angle to produce straight, spiral, or diamond knurls, using ordinary straight knurling rolls. The knurl holders have screw adjustment for setting to any diameter of work within the capacity of the tool. The shank is arranged to take a bushing for holding end or internal cutting tools for operations to be combined with knurling. Pair of straight knurls furnished.

No.	No. of Machine where used	Diam. Shank, Inches	Length Shank, Inches	Diameter will Knurl, Inches	Length will Knurl, Inches	Length Body, Inches	Price
00	00, 00G & 19 Auto.	5-8	1 1-8	1-16 to 7-16	1	1 5-8	\$23.50
20	0 & 0G Automatic	3-4	1 3-4	1-8 to 9-16	1 1-2	2 3-8	23.50
22	1, 2 & 2G Auto.	1	2 $\frac{3}{16}$	3-16 { to 15-16 to 1 1-8	1 3-4 { 1-2 3 5-8	2 $\frac{11}{16}$	29.50
34	4 Pl. & 4 Wire Feed	1 3-4	3 1-4	3-8 { to 1 7-16 to 1 1-2	2	5	80.00
36	6 Pl. & 6 Wire Feed	2	3 1-4	1-2 { to 1 11-16 to 2	4 1-4 { 2 3-8	5 1-2	80.00

These adjustable knurl holders will produce either straight, spiral or diamond knurling, using ordinary straight knurling rolls. The knurls are mounted in holders which swivel to any angle, and are adjustable for diameter.

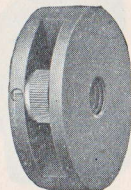


No.	No. of Machine where used	Length Will Knurl, Inches	Diam. of Hole in Body for Bushing, Inches	Price
24	4 Auto.	{ to 1 3-4 diam., 1 7-8 long or 1 5-8 diam., 3 1-2 long }	1 3-4	\$55.00
26	6 Auto.	{ to 2 diam., 2 1-4 long or 1 7-8 diam., 4 1-4 long }	2	60.00

## Knurl Holders for Cross Slide

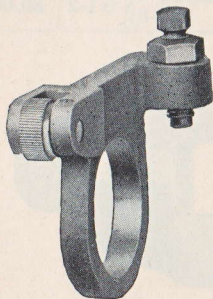
### Side Knurl Holders

Side Knurl Holders are used on either front or back tool posts. They are held in place in same manner as circular form tools and do not permit the use of any other tool on the same post at the same time. They are used for thread rolling on brass in addition to knurling. A straight knurl is furnished.



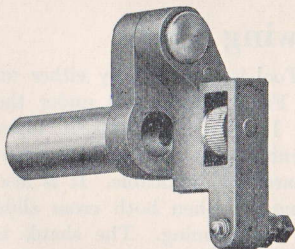
No.	No. of Machine where used	Diameter Holder, Inches	Width Holder, Inches	Width Knurl, Inches	Price
00A	00, 00G and 19	1 3-4	9-16	3-16	\$6.25
20A	0 and 0G	2 1-4	5-8	1-4	8.00
21A	1	2 1-2	11-16	1-4	8.75
22A	2 and 2G	3	11-16	1-4	9.75

### Top Knurl Holders



Top Knurl Holders are used on the back tool post, the knurl passing over the work. They are held on a hub on the circular tool between the tool and post, both circular tool and knurl holder being clamped by one bolt. They are also used for thread rolling on brass, in which case the cutting off tool is mounted on the same tool post. A straight knurl is furnished.

No.	No. of Machine where used	Capacity, Inches	Width Knurl, Inches	Price
00B	00, 00G and 19 Auto.	3-8	3-16	\$13.75
20B	0 and 0G Auto.	5-8	1-4	16.00
21B	1 Auto.	3-4	1-4	19.00
22B	2 and 2G Auto.	1 1-8	1-4	19.00



## Knurling Swing Tools

The Swing Knurl Holder is carried in the turret and is operated by either a Fixed or Adjustable Guide held under the front cross slide post. It carries a single knurl and is used for knurling behind shoulders of large diameter or where knurled section is at some distance from the end of the piece. A straight knurl is furnished.

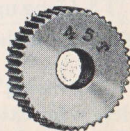
Price does not include either Fixed or Adjustable Guide.

No.	No. of Machine where used	Capacity, Inches	Diam. Shank, Inches	Length Shank, Inches	Length Body, Inches	Price
00K	00, 00G & 19Au.	{ 1 1-4 long up to 3-8 dia. 5-8 long up to 7-16 dia. 2 long up to 15-32 dia. 7-8 long up to 13-16 dia. 3 long up to 21-32 dia. 1 1-4 long up to 1 3-8 dia. }	5-8	1 5-8	1 1-4	\$34.00
20K	0 & 0G Auto.		3-4	2	1 3-4	35.50
22K	2 & 2G Auto.		1	2 1-2	2 3-16	42.50

## Straight Knurls for Screw Machine Tools

For use with the Turret and Cross Slide Knurling Holders listed on pages 375, 376, and 377. These knurls produce straight, spiral, or diamond knurling, depending upon the angle at which they are mounted. The teeth are cut to an included angle of 90 degrees. Knurls are made of tool steel and hardened.

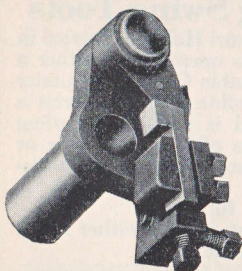
When ordering, specify diameter, width of face, size of hole, and number of teeth.



Outside Diameter, Inches	Width of Face, Inches	Diameter of Hole, Inches	No. of Teeth in Knurl			Approx. No. of Teeth per Inch	Knurl Holder where used	Price
1-2	3-16	3-16	84	73	65	53 47 41 55 35	00, 00A, 00B	\$1.00
5-8	1-4	1-4	92	81	68	47 41 35 56 47 29	20, 20A, 20B, 22	1.10
3-4	1-4	1-4	97	82	68	41 35 29 57 45 24	21A, 21B, 22A 22B, 24, 34	1.20
7-8	3-8	1-4	113	96	80	41 35 29 66 52 24	26, 36	1.40

Blanks of the above sizes are carried in stock from which diamond, spiral and straight cut knurls with any number of teeth can be made to order.



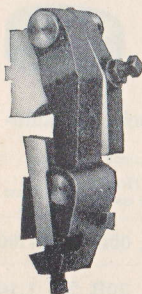


## Swing Tools

The Swing Tool is operated by either an Adjustable or Fixed Guide held under the front tool post. It is used for straight, taper or irregular turning where box tools or circular form tools are not applicable. It is also used for cutting off when both cross slide tools are used for forming. The shank is arranged to hold a back rest for supporting work. A tool blade is furnished.

No.	No. of Machine where used	Capacity, Inches	Dia. Shank, Inches	Lgth. Shank, Inches	Length Body, Inches	Price
00C	00, 00G, 19	1 1-4 long up to 3-8 dia.	5-8	1 5-8	1 1-16	\$34.00
20C	0 and 0G	{ 2 long up to 15-32 dia. 7-8 long up to 5-8 dia.	3-4	2	1 1-2	35.50
20B	0 and 0G	{ 2 long up to 15-32 dia. 1 1-8 long up to 5-8 dia.	3-4	2	1 3-4	35.50
22C	2 and 2G	{ 3 long up to 21-32 dia. 1 1-8 long up to 1 dia.	1	2	1 7-8	38.50
22B	2 and 2G	{ 3 long up to 21-32 dia. 1 3-4 long up to 1 dia.	1	2	2 17-32	42.50

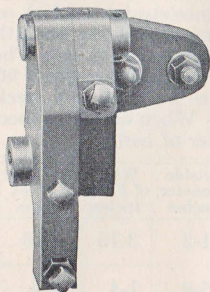
Price does not include Fixed or Adjustable Guide.



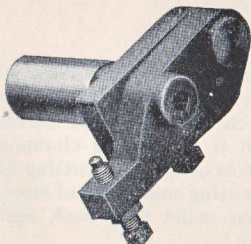
The Swing Tool shown on the left is for external work on the Nos. 4 and 6 Automatic Screw Machines, and the Recessing Swing Tool shown on the right is for internal work on the same machines.

Fixed or Adjustable guides are not included.

See page 381.



No.	No. of Machine where used	Swings from Center	Price
24 } 24H }	4 Automatic	{ 13-16 7-16	\$56.00 48.00
26 } 26H }	6 Automatic	{ 7-8 1-2	58.00 50.00



## Recessing Swing Tools

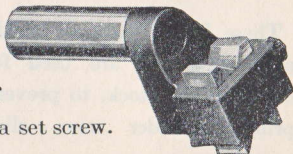
The Recessing Swing Tool is operated in the same manner as the Swing Tool. It is used for chamfering and recessing internally.

Price does not include Fixed or Adjustable Guide.

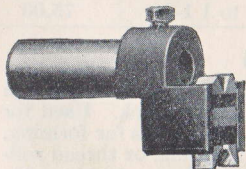
No.	No. of Machine where used	Swing from Center, Inches	Diameter Shank, Inches	Length Shank, Inches	Length Body, Inches	Price
00H	00, 00G, 19	3-16	5-8	1 3-8	15-16	\$35.50
20H	0 and 0G	1-4	3-4	1 3-4	1 1-4	38.50
22H	2 and 2G	9-32	1	2	2 1-4	42.50

## Back Rests for Swing Tools

Inserted in the hole in the shank of swing tool holders and held in place by a set screw.



No.	No. of Machine where used	Capacity, Inches	Diameter Shank, Inches	Length Shank, Inches	Length Body, Inches	Price
00	00, 00G, 19	1-4	7-16	1 7-16	3-4	\$9.75
20	0 and 0G	5-16	1-2	1 11-16	1	13.75
22	2 and 2G	1-2	11-16	2 1-4	1 7-16	17.75

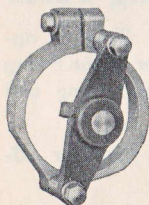


## Back Rests for Turret

Clamped in any of the turret holes. A set screw is provided in the shank for holding a stock stop or end cutting tool in the shank.

No.	No. of Machine where used	Capacity, Inches	Diameter Shank, Inches	Length Shank, Inches	Length Body, Inches	Price
00	00, 00G & 19 Auto.	3-8	5-8	1 3-4	13-16	\$8.75
00A	00, 00G & 19 Auto.	3-8	5-8	1 1-8	1 1-2	9.75
20	0 & 0G Auto.	5-8	3-4	1 3-4	1 5-8	14.00
22	1, 2, and 2G Auto.	1 1-8	1	2 3-8	1 3-4	19.00

## Back Rest for Chuck

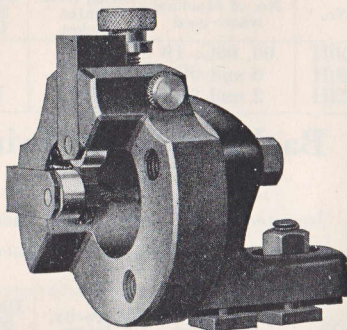


No. 00 Back Rest is used only on the Nos. 00, 00G, and 19 Automatic Screw Machines. It clamps over the outside of the chuck guard and carries a floating head in which a bushing is clamped. Used between collet and tools or between cutting off and forming tools for supporting small sizes of stock. Greatest distance between collet and back rest, 1 inch.

**Price:** No. 00 Back Rest with one blank bushing, \$50.00

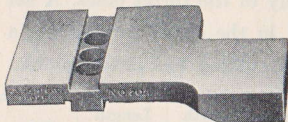
## Back Rests for Turret

These Back Rests are of the roller type and are used for steadying the stock, to prevent springing, under cross - slide operations.



No.	No. of Machine where used	Used on Work Diameter, Inches	Price
24	4 Automatic	5-16 to 1 1-4	\$70.00
26	6 Automatic	3-8 to 1 1-2	75.00

## Fixed Guides

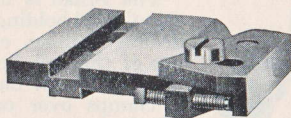


Held under front tool post in place of raising block. Used for operating swing tools for forming, recessing, knurling, or thread rolling. The front face acts as a guide for controlling the motion of the arm of the swing tool while cutting.

No.	No. of Machine where used	Length Guide, Inches	Price
00A	00, 00G and 19 Auto	1 3-8	\$8.00
20A	0 and 0G	1 3-4	9.75
22A	2 and 2G	2	13.75



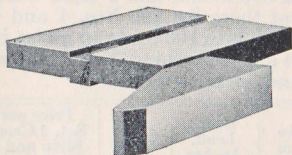
## Adjustable Guides



The Adjustable Guide is held under the front tool post and is used in connection with swing and taper turning tools. The arm carrying the guide can be adjusted in and out. The guide has an angular adjustment with the line of the spindle.

No.	No. of Machine where used	Length of Guide, Inches	Guide Swings Through Angle	Price
00	00, 00G and 19	1 5-8	30° incl.	\$9.75
20	0 and 0G	2 1-4	30° incl.	12.00
22	2 and 2G	3 1-8	30° incl.	16.00

## Fixed Guides

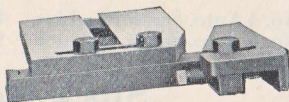


Held under front tool post in place of raising block. Used for operating swing tools for forming, recessing, knurling, or thread rolling. The front face acts as a guide for controlling the motion of the arm of the swing tool while cutting.

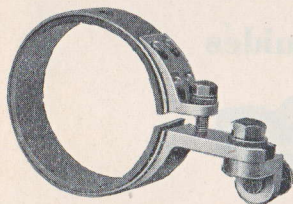
No.	No. of Machine where used	Length of Guide, Inches	Price
24A	4 Automatic	5 7-8	\$29.00
26A	6 Automatic	6 1-2	29.00

## Adjustable Guides

For taper turning with swing tools. They have adjustment of guide toward or from line of spindle and swing of guide through an included angle of 30 degrees.



No.	No. of Machine where used	Length of Guide, Inches	Price
24	4 Automatic	5	\$39.00
26	6 Automatic	6 3-8	39.00



## Spindle Brakes

The Brake is used for stopping the spindle and holding it rigidly while cross drilling, milling, etc. It is applied to one of the spindle pulleys in place of the belt, except on the No. 2G, where it clamps over one of the sprocket wheels.

No.	No. of Machine where used	Width, Inches	Outside Diameter, Inches	Inside Diameter, Inches	Price
00	00 Auto.	1 1-4	4 3-8	4	\$27.50
00G	00G Auto.	1 1-4	4 3-8	4	40.00
20	0 Auto.	2	6 7-16	6	34.00
20G	0G Auto.	2	6 7-16	6	50.00
22	2 Auto.	2 1-2	7 1-2	7	36.50
22G	2G Auto.	1 3-16	4 7-8	4 11-32	55.00

## Cam Blanks

Cam Blanks are put up in sets of three, 2 Cross Slide and 1 Lead Cam. They are made of mild steel and all except those for the Nos. 4 and 6 machines are bored and turned and graduated into 100 parts to assist in laying out the cam. Cam Blanks for Nos. 4 and 6 machines are provided with necessary holes, but are left square and are not graduated.

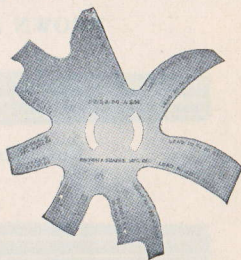
No. of Machine where used	Diam. Cross Slide, Inches	Price Each	Diam. Lead, Inches	Price Each	Price per Set, 2 Cross Slide and 1 Lead Cam
00, 00G and 19 Automatic Screw Machine	4 1-2	\$1.00	4 1-2	\$1.00	\$3.00
0 and 0G Automatic Screw Machine	6	1.30	5	1.00	3.00
1, 2 and 2G Automatic Screw Machine	7	1.70	6	1.30	3.90
No. 4 Auto. Screw Machine	8	2.40	7	1.30	3.90
No. 6 Auto. Screw Machine	9	3.00	7	1.70	5.10
			8	1.70	5.10
			9	2.00	5.40
			12	5.70	10.50
			15	9.00	15.00

## Stock Stops for Turrets

The stops are finished tapered on one end and are hardened.	Price
For Nos. 00 and 00G Automatic Screw Machines.....	\$0.55
For Nos. 0 and 0G Automatic Screw Machines.....	.55
For No. 1 Automatic Screw Machine.....	.65
For Nos. 2 and 2G Automatic Screw Machines.....	.65

## Cam Templates

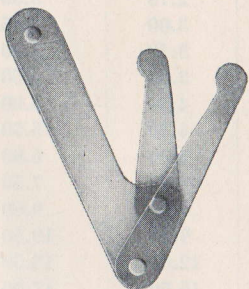
Cam Templates are used for laying out the rise and drop on the cam lobes for various speeds. The one shown is used with the No. 0 and 0G Automatic Screw Machines. The templates for the other sizes of machines differ slightly in appearance but cover the same requirements.



They are made of German silver or celluloid as preferred. Specify which style desired when ordering.

### Prices:

For use with Nos. 00, 00G, and 19 Auto. Sc. Mach.....	\$5.50
For use with Nos. 0 and 0G Auto. Sc. Mach.....	6.75
For use with Nos. 2 and 2G Auto. Sc. Mach.....	8.00
For use with No. 4 Auto. Sc. Mach., for Cross Slide Cam	12.00
for Lead Cam.....	13.50
For use with No. 6 Auto. Sc. Mach., for Cross Slide Cam	13.00
for Lead Cam.....	24.00



## Lever Templates

Lever Templates are used for laying out cams in cases where very close timing is required, as for instance when a tool is operated by the combined action of the cross slide and turret slide. They are made from sheet celluloid.

### Prices:

For use with Nos. 00, 00G, and 19 Auto. Sc. Mach.....	\$6.75
For use with Nos. 0 and 0G Auto. Sc. Mach.....	6.75
For use with Nos. 2 and 2G Auto. Sc. Mach.....	8.00
For use with No. 4 Auto. Sc. Mach .....	12.00
For use with No. 6 Auto. Sc. Mach .....	13.00



# Taper Reamers

## BROWN & SHARPE STANDARD



**Roughing Reamer, Style 960-F**



**Finishing Reamer, Style 961-F**

## Roughing and Finishing

No. of Taper	Total Length, Inches	Length of Flutes, Inches	Price, Each Roughing	Price, Each Finishing
1	4 3-4	2 7-8	\$2.25	\$2.60
2	5 1-8	3 1-8	2.50	2.95
3	5 1-2	3 3-8	2.75	3.30
4	5 7-8	3 11-16	3.00	3.65
5	6 3-8	4	3.40	4.00
6	6 7-8	4 3-8	3.80	4.50
7	7 1-2	4 7-8	4.30	5.00
8	8 1-8	5 1-2	4.80	5.50
9	8 7-8	6 1-8	5.30	6.00
10	9 3-4	6 7-8	6.50	7.50
11	10 5-8	7 5-8	8.00	9.00
12	11 3-8	8 1-4	9.50	10.50
13	12	8 3-4	12.00	13.50
14	12 1-2	9 1-4	15.50	17.00
15	13 1-8	9 3-4	19.00	21.00
16	13 1-2	10 1-4	23.00	26.00
17	13 3-4	10 3-4	29.00	33.00
18	14 1-4	11 1-4	36.00	40.00

List of Standard Tapers and Taper Holes, page 234.

## Ground Flat Stock

This stock is of service not only in tool work for making flat gauges, test tools, "jig work," etc., but in all work requiring steel of a definite thickness.

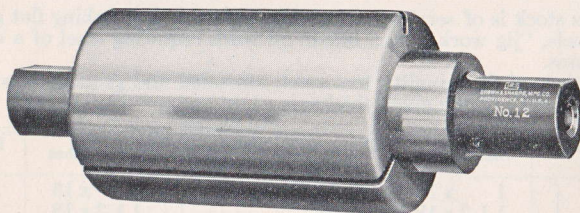
Stock is of first quality tool steel, annealed and ground to within a limit of .001" of the given thickness.

Thickness, Inches	Size, Inches	Price, per Piece	Thickness, Inches	Size, Inches	Price, per Piece
1-64	1 x 18	\$0.85	5-32	1 x 18	\$0.85
	1 1-2 x 18	1.05		1 1-2 x 18	1.10
	2 x 18	1.25		2 x 18	1.40
	2 1-2 x 18	1.55		2 1-2 x 18	1.60
	3 x 18	1.85		3 x 18	1.80
	3 1-2 x 18	2.15		3 1-2 x 18	2.00
1-32	4 x 18	2.50	3-16	4 x 18	2.30
	1 x 18	.60		1 x 18	.95
	1 1-2 x 18	.80		1 1-2 x 18	1.20
	2 x 18	1.00		2 x 18	1.50
	2 1-2 x 18	1.25		2 1-2 x 18	1.70
	3 x 18	1.50		3 x 18	2.00
1-16	3 1-2 x 18	1.75	7-32	3 1-2 x 18	2.30
	4 x 18	2.00		4 x 18	2.60
	1 x 18	.50		1 x 18	1.05
	1 1-2 x 18	.70		1 1-2 x 18	1.35
	2 x 18	.90		2 x 18	1.60
	2 1-2 x 18	1.10		2 1-2 x 18	1.90
3-32	3 x 18	1.35	1-4	3 x 18	2.20
	3 1-2 x 18	1.60		3 1-2 x 18	2.60
	4 x 18	1.85		4 x 18	3.00
	1 x 18	.70		1 x 18	1.15
	1 1-2 x 18	.85		1 1-2 x 18	1.45
	2 x 18	1.00		2 x 18	1.80
1-8	2 1-2 x 18	1.20		2 1-2 x 18	2.20
	3 x 18	1.40		3 x 18	2.60
	3 1-2 x 18	1.65		3 1-2 x 18	3.05
	4 x 18	1.90		4 x 18	3.50
	1 x 18	.75			
	1 1-2 x 18	.90			
	2 x 18	1.05			
	2 1-2 x 18	1.30			
	3 x 18	1.50			
	3 1-2 x 18	1.75			
	4 x 18	2.00			

Other sizes furnished to order.

Prices upon application.

# Taper Mandrels and Expansion Bushings



## Taper Mandrels

Mandrel No.	Whole Length, Inches	Diam. at Small End, Inches	Price	Mandrel No.	Whole Length, Inches	Diam. at Small End, Inches	Price
3	3 11-16	.3125	\$2.55	9	7 3-16	.90	\$4.70
4	4 1-16	.35	2.70	10	7 3-4	1.05	5.50
5	4 1-2	.45	3.00	11	8 3-8	1.25	6.40
6	5 1-8	.50	3.30	12	9	1.50	7.30
7	5 15-16	.60	3.60	13	9 5-8	1.75	8.60
8	6 9-16	.75	4.15	..	...	....	....

Mandrels take Bushings as follows: No. 3, 2 sizes; Nos. 4, 5, 6, 7 and 8, 3 sizes; Nos. 9, 10, 11, 12 and 13, 6 sizes.

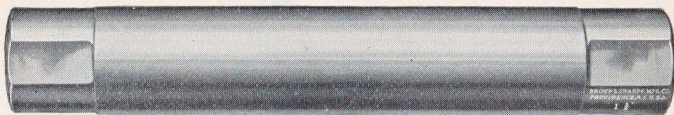
## Expansion Bushings

These Bushings are cast iron. They are intended to fit standardized holes, and are capable of expanding .005 to .007 of an inch.

Outside Diameter of Bushing, Inches	Length, Inches	For Mandrel No.	Price	Outside Diameter of Bushing, Inches	Length, Inches	For Mandrel No.	Price
1-2	1 1-2	3	\$1.00	2	4	10	\$3.70
9-16	1 5-8	3	1.00	2 1-16	4 1-8	10	3.70
5-8	1 3-4	4	1.20	2 1-8	4 1-8	10	3.70
11-16	1 7-8	4	1.20	2 3-16	4 1-4	10	3.70
3-4	2	4	1.20	2 1-4	4 1-4	10	3.70
13-16	2 1-8	5	1.50	2 5-16	4 3-8	11	4.35
7-8	2 1-4	5	1.50	2 3-8	4 3-8	11	4.35
15-16	2 3-8	5	1.50	2 7-16	4 1-2	11	4.35
1	2 1-2	6	1.75	2 1-2	4 1-2	11	4.35
1 1-16	2 5-8	6	1.75	2 9-16	4 5-8	11	4.35
1 1-8	2 3-4	6	1.75	2 5-8	4 5-8	11	4.35
1 3-16	2 7-8	7	2.10	2 11-16	4 3-4	12	5.10
1 1-4	3	7	2.10	2 3-4	4 3-4	12	5.10
1 5-16	3 1-8	7	2.10	2 13-16	4 7-8	12	5.10
1 3-8	3 1-4	8	2.55	2 7-8	4 7-8	12	5.10
1 7-16	3 3-8	8	2.55	2 15-16	5	12	5.10
1 1-2	3 1-2	8	2.55	3	5	12	5.10
1 9-16	3 5-8	9	3.15	3 1-16	5 1-8	13	5.80
1 5-8	3 5-8	9	3.15	3 1-8	5 1-8	13	5.80
1 11-16	3 3-4	9	3.15	3 3-16	5 1-4	13	5.80
1 3-4	3 3-4	9	3.15	3 1-4	5 1-4	13	5.80
1 13-16	3 7-8	9	3.15	3 5-16	5 3-8	13	5.80
1 7-8	3 7-8	9	3.15	3 3-8	5 3-8	13	5.80
1 15-16	4	10	3.70	....	....	..	....



## Lathe Mandrels



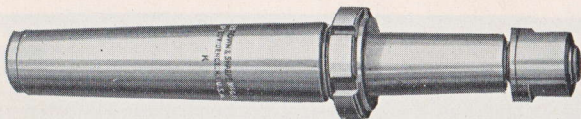
These Mandrels are of tool steel, hardened and accurately ground. They are tapered .0005" to one inch.

The Mandrels from 1-4" to 1" are .0005" below size at the small end, and those from 1 1-16" to 4", .001" below size at the small end.

Diameter, Inches	Total Length Inches	Price	Diameter, Inches	Total Length, Inches	Price
3-16	3 3-4	\$0.75	1 7-8	10 1-2	\$5.50
1-4	3 3-4	.80	1 15-16	10 3-4	6.00
5-16	4	.90	2	11	6.50
3-8	4 1-4	1.00	2 1-16	11 1-2	7.00
7-16	4 1-2	1.10	2 1-8	11 1-2	7.50
1-2	5	1.20	2 3-16	12	8.00
9-16	5 1-4	1.30	2 1-4	12	8.50
5-8	5 1-2	1.40	2 5-16	12	9.00
11-16	5 3-4	1.50	2 3-8	12	9.50
3-4	6	1.60	2 7-16	12 1-2	10.00
13-16	6 1-4	1.70	2 1-2	12 1-2	10.50
7-8	6 1-2	1.85	2 9-16	12 1-2	11.25
15-16	6 3-4	2.00	2 5-8	12 1-2	12.00
1	7	2.15	2 11-16	13	12.75
1 1-16	7 1-4	2.30	2 3-4	13	13.50
1 1-8	7 1-2	2.45	2 13-16	13	14.25
1 3-16	7 3-4	2.60	2 7-8	13	15.00
1 1-4	8	2.80	2 15-16	13	15.75
1 5-16	8 1-4	3.00	3	13	16.50
1 3-8	8 1-2	3.25	3 1-8	14	18.00
1 7-16	8 3-4	3.50	3 1-4	14	19.50
1 1-2	9	3.75	3 3-8	15	21.00
1 9-16	9 1-4	4.00	3 1-2	15	23.00
1 5-8	9 1-2	4.25	3 5-8	16	25.00
1 11-16	9 3-4	4.50	3 3-4	16	27.00
1 3-4	10	4.75	3 7-8	17	29.00
1 13-16	10 1-4	5.00	4	17	31.00

## Work Arbors

### For Automatic Gear Cutting Machines



Mark	No. of Machine where used	No. of Taper of Shank	Length of Bushing, Inches	No. of Taper for Bushing	Smallest Possible Bush., In.	Price
*I	3 and 13	10	3	6	3-4	\$16.00
J	3 and 13	12	3 1-2	9	1 1-4	25.50
K	3 and 13	12	3 1-2	11	1 3-4	25.50
*M	3H, 4 and 13H	11	3 1-2	7	1	20.00
†N	3H and 4	14	5	10	1 1-2	28.00
†O	3H and 4	14	5	12	2	28.00
P	13H	14	5	10	1 1-2	26.50
*Q	5	12	4 1-2	10	1 1-2	25.50
†R	5	16	6	13	2 1-2	45.00
†S	5	16	6	14	3 1-4	45.00
T	13H	14	5	12	2	30.00
†*U	6	14	6	12	2 1-4	50.00
†V	6	18	7 1-2	14	3	55.00
†W	6	18	9	18	4	60.00

Arbors marked \* are for use in the Collets.

†These arbors differ from one shown in cut in having a teat or straight end extending beyond nut and fitting into the bushing of outer support furnished with the Nos. 3H, 4, 5, and 6 machines.

## Expansion Bushings for Work Arbors

### For Automatic Gear Cutting Machines

Outside Diam., Inches	No. of Machine where used	Length, Inches	No. Taper Holes	Used with Arbor	Price
3-4	3 and 13	3	6	E and I	\$2.00
7-8	3 and 13	3	6	E and I	2.00
1	3 and 13	3	6	E and I	2.00
1 1-8	3 and 13	3	6	E and I	2.00
1 1-4	3 and 13	3 1-2	9	F and J	2.55
1 3-8	3 and 13	3 1-2	9	F and J	3.00
1 1-2	3 and 13	3 1-2	9	F and J	3.00
1 5-8	3 and 13	3 1-2	9	F and J	3.75

In ordering, state outside diameter, and letter of Arbor.

Bushings marked \* can be used on Withdrawing Work Arbors furnished.

Bushings marked † are furnished with the machine.

*List continued on next page.*

# Expansion Bushings for Work Arbors

For Automatic Gear Cutting Machines (*Continued*)

Outside Diameter, Inches	No. of Machine where used	Length, Inches	No. Taper Holes	Used with Arbor	Price
1 3-4	3 and 13	3 1-2	11	K	\$3.75
2	3 and 13	3 1-2	11	K	4.35
2 1-4	3 and 13	3 1-2	11	K	4.35
1	3H, 4 and 13H	3 1-2	7	M	2.00
1 1-8	3H, 4 and 13H	3 1-2	7	M	2.00
1 1-4	3H, 4 and 13H	3 1-2	7	M	2.55
1 3-8	3H, 4 and 13H	3 1-2	7	M	3.00
1 1-2	3H, 4 and 13H	5	10	N and P	3.00
1 5-8	3H, 4 and 13H	5	10	N and P	3.75
1 3-4	3H, 4 and 13H	5	10	N and P	3.75
2	3H, 4 and 13H	5	10	N and P	4.35
2	3H, 4 and 13H	5	12	O and T	4.35
2 1-4	3H, 4 and 13H	5	12	O and T	4.35
2 1-2	3H, 4 and 13H	5	12	O and T	5.25
2 3-4	3H, 4 and 13H	5	12	O and T	6.15
3	3H, 4 and 13H	5	12	O and T	6.90
1 1-2	5	4 1-2	10	Q	3.00
1 5-8	5	4 1-2	10	Q	3.75
1 3-4	5	4 1-2	10	Q	3.75
2	5	4 1-2	10	Q	4.35
2 1-4	5	4 1-2	10	Q	4.35
*2 1-2	5	6	13	R	5.25
*2 3-4	5	6	13	R	6.15
†*3	5	6	13	R	6.90
*3 1-4	5	6	13	R	6.90
3 1-4	5	6	14	S	6.90
*3 1-2	5	6	13	R	7.20
3 1-2	5	6	14	S	7.20
2 1-4	6	6	12	U	4.35
2 1-2	6	6	12	U	5.25
2 3-4	6	6	12	U	6.15
*3	6	7 1-2	14	V	7.30
*3 1-4	6	7 1-2	14	V	6.75
*3 1-2	6	7 1-2	14	V	7.15
*3 3-4	6	7 1-2	14	V	8.25
†*4	6	7 1-2	14	V	8.50
4	6	9	18	W	8.90
4 1-2	6	9	18	W	9.90
5	6	9	18	W	10.90

In ordering, state outside diameter and letter of Arbor.

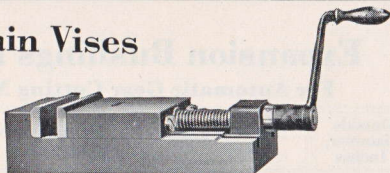
Bushings marked \* can be used on Withdrawing Work Arbors furnished.

Bushings marked † are furnished with the machine.



## Plain Vises

Furnished with jaws of hardened steel unless otherwise specified.



No.	Width of Jaws, Inches	Depth of Jaws, Inches	Jaws Open, Inches	Shipping Weight, Lbs.	Price
1-P	4 1-8	1 1-16	2	17	\$24.00
2-P	5 1-8	1 1-4	2 3-4	27	25.00
3-P	6 1-8	1 9-16	3 5-8	50	34.00
4-P	7 1-8	2	4 1-2	90	51.00

## Flanged Vises

Furnished with jaws of hardened steel unless otherwise specified.

These vises are provided with flanges for clamping them to the table of Milling or Planing Machines.

Furnished with bolts, nuts, washers and clamp.

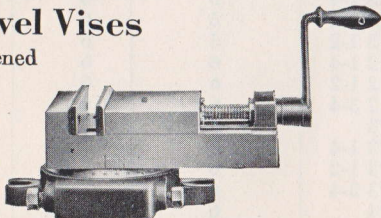


No.	Width of Jaws, Inches	Depth of Jaws, Inches	Jaws Open, Inches	Shipping Weight, Lbs.	Price
1-F	4 1-8	1 1-16	2	20	\$25.00
2-F	5 1-8	1 1-4	2 3-4	36	28.00
3-F	6 1-8	1 9-16	3 5-8	64	43.00
4-F	7 1-8	2	4 1-2	110	63.00
5-F	8 5-8	2 1-2	7	195	89.00

## Swivel Vises

Furnished with jaws of hardened steel unless otherwise specified.

The vise is clamped to the base by either one of the two clamping bolts. The vises are furnished with tongues as follows: No. 2-S, 5-8"; Nos. 3-S and 4-S, reversible for 5-8" or 3-4" slots.



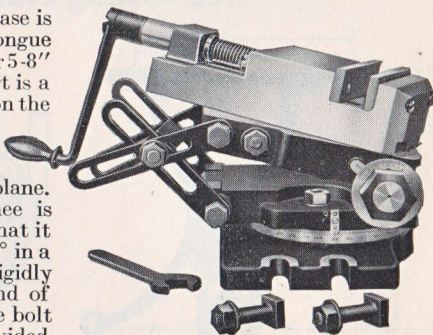
No.	Width of Jaws, Inches	Depth of Jaws, Inches	Jaws Open, Inches	Height, Inches	Shipping Weight, Lbs.	Price
2-S	5 1-8	1 1-4	2 3-4	4 1-2	49	\$40.00
3-S	6 1-8	1 9-16	3 5-8	5 3-16	85	50.00
4-S	7 1-8	2	4 1-2	6 3-8	142	70.00

## Toolmakers' Universal Vises

The lower part of the base is provided with a reversible tongue which can be used with either 5-3" or 3-4" slots. The upper part is a hinged knee, which swivels on the lower part of the base. The lower part of the knee is graduated and can be set at any angle in a horizontal plane. The upper part of the knee is hinged in such a manner that it can be set at any angle to 90° in a vertical plane and clamped rigidly in position by the nut on end of bolt forming the hinge. The bolt forming the hinge is provided with a hardened steel dial graduated to 90°. The upper surface is graduated to degrees for setting the vise proper in a horizontal plane.

The vise proper swivels on the upper part of the hinged knee, can be set at any angle to the axis of the bolt forming the hinge and clamped in position.

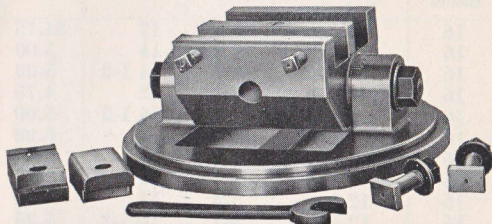
The jaws are of tool steel, hardened and ground, unless otherwise specified. Each vise is furnished with a wrench.



No.	Width of Jaws, Inches	Depth of Jaws, Inches	Jaws Open, Inches	Net Weight, Lbs.	Shipping Weight, Lbs.	Price
2-T	5 1-8	1 1-4	2 3-4	65	80	\$83.00
3-T	6 1-8	1 9-16	3 5-8	135	160	110.00

## Adjustable Swivel Vise

Adapted for use on Planing and Surface Grinding Machines



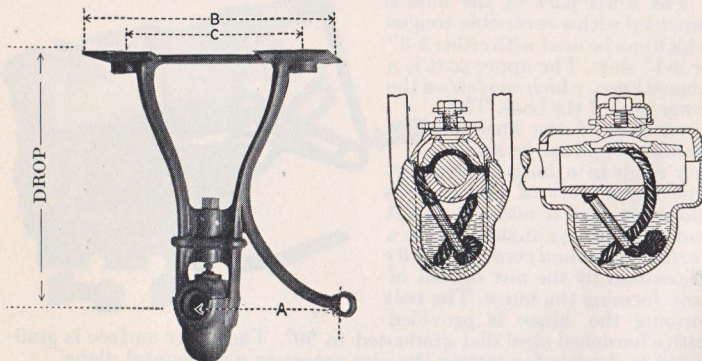
This Vise can be set at any angle with the T slots of the table and is pivoted so that it can be set at any angle to 40 degrees either side of the horizontal, the position being indicated by a graduated arc. Bolts,

nuts, washers and clamps are furnished. Height of vise, 4".

The jaws are 5" wide, 1" deep, and will open 2 3-4".

Shipping Weight: Net, about 30 lbs.; ready for shipment, about 40 lbs. Dimensions for shipment, 13" x 12" x 6". Price, \$38.00.

## Self-Oiling Hangers



These hangers are entirely self-oiling, a large supply of oil being carried in the reservoir and fed to the bearings through a wick by capillary attraction. They can be furnished with or without arms and with one end of the drip closed or both ends open.

Two shipper rod stops and one shipper dog are furnished with each pair of hangers with arms. When hangers and friction pulleys are ordered together, a shipper fork is sent. The feet on all sizes of hangers are 4 1-2" wide.

### No. 1

Takes Boxes 1" x 4" or 1 1-4" x 4 1-2"

Drop, Inches	Distance from Center of Shaft to Shipper Rod A, Inches	Extreme Width B, Inches	Distance Between Centers of Bolt Holes C, Inches	Diameter of Holes, Inches	Net Weight, Lbs.	Single Hanger, Price
10	No arm	16	12 1-8	3-4	12	\$4.75
10	7 9-16	16	12 1-8	3-4	14	5.00
10	8 5-16	16	12 1-8	3-4	14 1-2	5.00
12	No arm	16	12 1-8	3-4	12	4.75
12	7 9-16	16	12 1-8	3-4	14 1-2	5.00
12	8 5-16	16	12 1-8	3-4	14	5.00
12	9 7-16	16	12 1-8	3-4	15	5.00
12	10 9-16	16	12 1-8	3-4	15	5.00
16	No arm	16	12 1-8	3-4	14	5.00
16	7 9-16	16	12 1-8	3-4	16 1-2	5.25
16	8 5-16	16	12 1-8	3 4	20	5.25
16	9 7-16	16	12 1-8	3-4	20	5.25
17	No arm	16	12 1-8	3-4	15	5.00
18	No arm	16	12 1-8	3-4	15	5.00



## Self-Oiling Hangers

**No. 2**

**Takes Boxes 1 1-2" x 6" or 1 5-8" x 6 1-2"**

Drop, Inches	Distance from Center of Shaft to Shipper Rod A, Inches	Extreme Width B, Inches	Distance Between Centers of Bolt Holes C, Inches	Diameter of Holes, Inches	Net Weight, Lbs.	Single Hangers, Price
12	No arm	16	12 1-8	7-8	16	<b>\$7.00</b>
12	9 7-16	16	12 1-8	7-8	18 1-2	<b>7.25</b>
12	11 5-16	16	12 1-8	7-8	18 1-2	<b>7.25</b>
12	9 7-16 and 11 7-16	16	12 1-8	7-8	21	<b>7.25</b>
12	11 5-16 and 13 1-16	16	12 1-8	7-8	21	<b>7.25</b>
16	No arm	16	12 1-8	7-8	20	<b>7.25</b>
16	9 7-16	16	12 1-8	7-8	23	<b>7.50</b>
16	11 1-16	16	12 1-8	7-8	25	<b>7.50</b>
16	11 1-16 and 13 1-16	16	12 1-8	7-8	26	<b>7.50</b>

**No. 3**

**Takes Boxes 1 11-16" x 6 1-2", 1 15-16" x 7" or 2 3-16" x 7 1-2"**

12	10 13-16	19	15	1 1-8	36	<b>\$14.50</b>
12	10 13-16 and 12 13-16	19	15	1 1-8	38	<b>14.50</b>
14	12 13-16	19	15	1 1-8	43	<b>15.00</b>
14	12 13-16 and 14 13-16	19	15	1 1-8	44	<b>15.00</b>

**\*No. 5**

**Takes Boxes 2" x 8", 2 3-16" x 9" or 2 7-16" x 10"**

16	No arm	22	18	1 1-8	53 1-2	<b>\$21.00</b>
16	12 9-16	22	18	1 1-8	57	<b>21.50</b>
16	12 9-16 and 14 9-16	22	18	1 1-8	58	<b>21.50</b>

\*Differs slightly from one shown in cut on opposite page.

## Counter Shafts

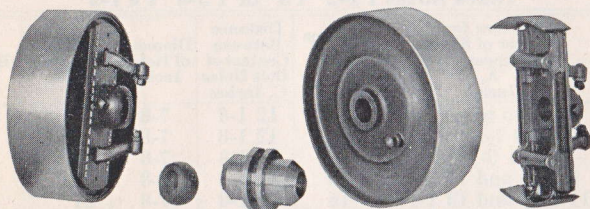
**With Friction Pulleys, Hangers and Boxes**

Price includes shaft, one pair of Pad Type Self-Oiling Friction Pulleys, one pair Self-Oiling Hangers, shipper rod, forks, stops and stud for attaching shipper handle.

With Friction Pulleys, Diameter, Inches	Length of Shaft in Clear Be- tween Hangers, Inches	Diameter of Shaft, Inches	Diameter of Bearing, Inches	Net Weight, Lbs.	Price
8	26	1 1-4	1	114	<b>\$35.00</b>
10	33	1 1-4	1	136	<b>41.00</b>
12	33	1 1-2	1 1-4	169	<b>45.00</b>
14	33	1 1-2	1 1-4	185	<b>49.00</b>
16	44	1 11-16	1 1-2	254	<b>65.00</b>
18	44	1 11-16	1 1-2	286	<b>75.00</b>

## Self-Oiling Friction Pulleys

### Pad Type



The pad type friction pulleys are simple in construction and noiseless when in use. Friction is applied when the thimble is pushed between the set screws in the end of the two operating levers, the levers spread and bring the two friction pads in contact with the inside rim of the pulley. Each pulley contains a center oil pocket which lubricates the bronze bearing when the pulley is running idle. All the parts are easily adjusted to compensate for wear.

Each pair of pulleys has one thimble and two collars. Each single pulley has one thimble and one collar.

When ordering two or more pulleys state if same are to be used singly or in pairs.

Diameter, Inches	Belt, Inches	Hole, Inches	Net Weight, Lbs.	Price, Each	Price, Per Pair
8	2 1-4	1 1-4	16	\$11.00	\$20.00
10	3	1 1-4	24	13.50	25.00
12	3 1-2	1 1-2	36	15.50	29.00
14	3 1-2	1 1-2 or 1 11-16	44	18.00	34.00
16	4	1 11-16	62	23.00	44.00
18	4 1-2	1 11-16	79	28.00	54.00

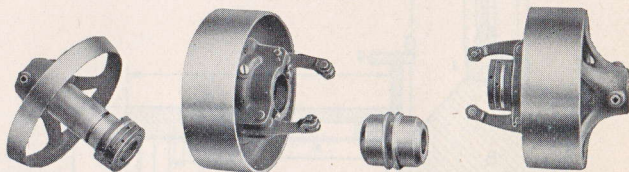
The space required to operate Friction Pulleys and the maximum speeds at which these pulleys can be run satisfactorily, are given in the table below:

Diameter of Pulley, Inches	Single Pulley, Inches	Two Pulleys, Inches	Three Pulleys, Inches	Max. Speed Revolutions Per Minute
8	10	16 1-4	...	450
10	12 3-8	20	...	375
12	14	23	42 5-8	325
14	14	23 1-4	43 1-8	275
16	15	25	...	250
18	15 1-2	26	...	225

Pulleys with special holes furnished when desired. **Prices on Application.**

## Self-Oiling Friction Pulleys

### Cone Type



The Cone Type pulley is designed for high speed and hard service. The pulley runs on the hub of the inner friction surface and is provided with a self-oiling bronze bushing, that amply lubricates the bearing when the pulley is running idle.

When the thimble is pushed between the hardened rolls in the ends of the levers, the levers spread and draw the friction surface of the pulley in contact with the friction cone. A thimble is furnished with each pulley or pair of pulleys. When ordering two or more pulleys state whether they are to be used singly or in pairs.

Diameter, Inches	Belt, Inches	Size of Hole, Inches	Weight, Lbs.	Single Pulley, Price	Price, Per Pair
8	2 1-2	1 1-4 or 1 1-2	23	<b>\$15.50</b>	<b>\$29.00</b>
10	3	1 1-2 or 1 11-16	37	<b>18.50</b>	<b>35.00</b>
12	3 1-2	1 1-2, 1 11-16 or 1 15-16	59	<b>23.00</b>	<b>44.00</b>
14	4	1 11-16 or 1 15-16	74	<b>29.00</b>	<b>56.00</b>
16	4 1-2	1 11-16, 1 15-16 or 2 3-16	93	<b>40.00</b>	<b>78.00</b>
18	6	2 3-16	172	<b>85.00</b>	<b>168.00</b>

The space required to operate Friction Pulleys is given in the table below:

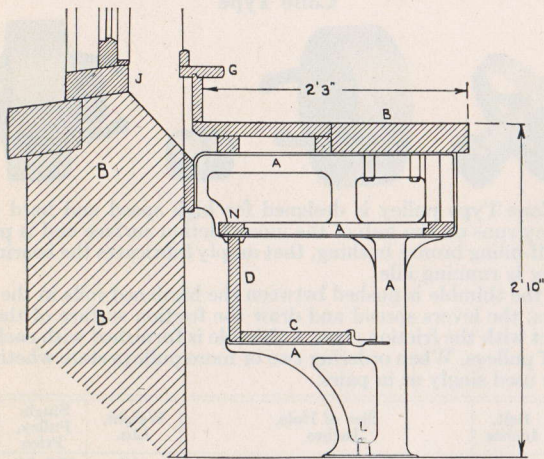
Diameter, Inches	Single Pulley, Inches	Two Pulleys, Inches	Three Pulleys, Inches
8	11 1-8	19	36 1-8
10	10 3-4	18 1-2	35 3-8
12	12 1-2	22	40 1-4
14	14 1-4	24 3-4	46 1-2
16	16 1-2	28 3-4	53 3-4
18	20 1-2	36 7-8	

Pulleys with special holes furnished when desired. **Prices on Application.**

It is often desirable for a machine to have three pulleys operated by one shipper rod so as to give different speeds in the same direction. For this purpose we furnish pulleys (at the regular price) with special long levers and thimbles on sizes 12" and 14" of the Pad Type and on sizes 8", 10", 12", 14" and 16" of the Cone Type.



# Improved Work Bench



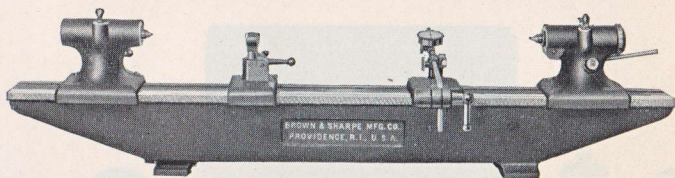
These Work Benches are of substantial construction and are suitable for iron and wood work. The leg or casting *a* consists of a rigid standard, a bracket for the support of the shelf *c*, and its accompanying back. The legs or standards are fastened to the floor by coach screws, shown at *l*, and are supported at the back by the wall *B B*. They are usually placed about 4 feet apart and support the bench *b*, the shelf *g*, the framework *n*, and the shelf *c*, with its accompanying back. The framework *n* forms a strong support upon which the drawers slide. The shelf *c* supported by the brackets is held in place by the cast-iron clip, shown at the front. The shelf *g* affords a neat and substantial support for electric light or gas brackets. The front of the leg or standard is provided with a hole to receive the bolt for holding the vise and this construction brings the vise directly over the leg or standard.

We are prepared to furnish these bench leg castings complete, drilled and ready for use. For the support of a bench at a corner the design of the casting varies slightly from that shown above and the use of castings for this purpose should be specified. We can also furnish complete sets of pattern castings for iron work of above described bench.

Drawings, showing instructions, sent with orders.

Bench Leg Castings.....	Price, each \$8.25
Corner Leg Castings.....	Price, each 9.75
Pattern Castings.....	Price, each 30.00

## Improved Bench Centers



**Price, With Indicator, \$140.00. Without Indicator, \$110.00.**

These centers swing 8" in diameter and take work 36" in length.

The head and foot-stock spindles are of steel, ground and accurately fitted. The foot-stock center is held firmly in contact with the work by a stiff spring and as the spindle is quickly operated by a lever, work can be easily placed in position and removed. Provision is made for clamping the foot-stock spindle when desired.

These bench centers are furnished with or without dial indicators. The indicators are graduated to read in either English or Metric Measure. The English Measure gauge reads in thousandths of an inch either side of zero. The Metric Measure gauge reads in hundredths of a millimetre either side of zero.

The movement of the dial spindle that bears upon the work is magnified a number of times on the dial. The graduations are wide spaced, making it easy to estimate one-half and one-quarter thousandths of an inch. The face of the dial can be adjusted to allow the setting of the zero graduation to any required position.

The sleeve that holds the dial indicator arm can be clamped at any height on the post or turned around to bring the arm on either side. The arm turns in the sleeve and may be set at any angle relative to the base. All parts are detachable.

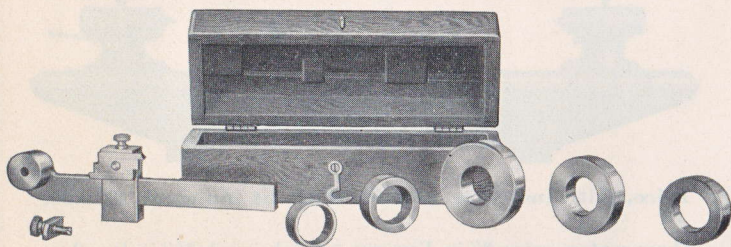
A work support is furnished.

All the parts are movable on the bed and are clamped in position by screws provided with fixed handles thus dispensing with wrenches.

**Shipping Weight, Lbs.** Net, about 150 lbs; weight for shipment, about 215 lbs. Dimensions for shipment, 55" x 12" x 14". Space occupied about 5 cubic feet.



## Cutter Clearance Gauge

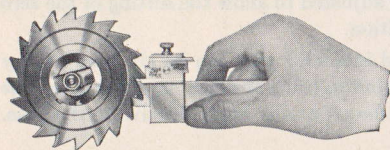


Price, \$50.00

This gauge is designed for the purpose of aiding the operator in grinding the correct angle of clearance on milling cutters. It consists of a hardened steel bar 6 1-2" long, to one end of which is attached a hardened stud 7-8" in diameter for holding the cutters. A set of five bushings is provided for the stud so that cutters having holes 7-8", 1", 1 1-4", 1 1-2", 1 3-4" and 2" may be tested. The bushing is held in place on the stud by a spring stop.

The gauge is mounted on a slide which is easily moved along the bar.

It is attached to the side of the slide by a pin which allows it to be revolved, one end being used for cutters under 3" in diameter, the other end for cutters 3" in diameter and over.



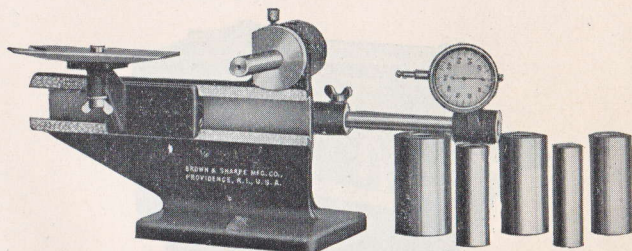
To test for correct clearance, the cutter is placed on the stud with proper bushing, and the gauge pushed forward. The cutter is then revolved sufficiently to bring the face of a

tooth in contact with the stop on the gauge which gives the correct position for the cutter. The angle of clearance on the tooth should then correspond to the angle of the gauge. Cutters of any width may be tested with the gauge.

The gauge and bushings are packed in a finished wooden box, as shown above.



## Cutter Testing Fixture



Price, \$75.00

Without Indicator, \$59.00

Gear and formed cutters are designed in such a manner that the faces of the teeth must be ground radially and all teeth must be of even height whenever they are sharpened. This fixture is designed especially for detecting the slightest inaccuracies in grinding. All sizes of cutters up to 10" in diameter can be accommodated.

A cutter is tested by bringing the face of each tooth to bear upon a hardened-steel plate whose top surface is radial with the stud upon which the cutter is supported; all points of the cutting contour should simultaneously touch the surface of the testing plate. At the same time the dial indicator shows whether the teeth are all of the same height.

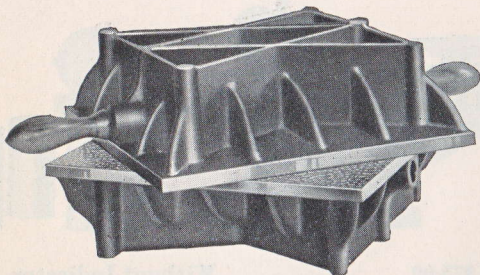
The testing plate is reversible and is attached by a bolt and thumb nut to a slide that moves in horizontal ways cut in the side of the fixture body. By this arrangement the plate can be readily inserted to test a tooth and withdrawn to permit the following tooth to be brought into position. A taper gib on the slide provides means of taking up the wear and keeping the surface of the testing plate correctly lined.

The stud upon which the cutters are supported is made of hardened steel, 5-8" diameter. It has a taper shank which fits into a taper steel sleeve that is fastened securely in the fixture body.

The dial indicator reads to thousandths of an inch **English Measure** or hundredths of a millimetre **Metric Measure**.

**Equipment:** Five bushings, hardened and ground, 7-8", 1", 1 1-4", 1 1-2" and 1 3-4" diameter, and a collar for use when testing thin cutters.

## Standard Cast Iron Surface Plates

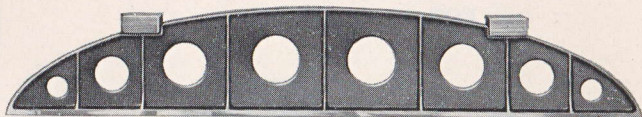


These plates are usually sold singly, not in pairs, as shown in cut. Prices quoted are for single plate with cover.

Size, Inches	Approximate Weight, Lbs.	Price, Including Cover	Size, Inches	Approximate Weight, Lbs.	Price, Including Cover
3 1-2 x 4	2	\$8.00	12 x 18	58	\$45.00
3 1-2 x 12	10	15.00	12 x 24	92	62.50
4 x 7	6	10.00	12 x 36	158	90.00
4 x 15	17	18.00	*12 x 144	2000	510.00
4 x 18	18	20.00	*12 x 65	390	180.00
*4 x 40	80	37.50	14 x 14	52	38.50
4 1-2 x 6	5	10.00	14 x 18	58	50.00
5 x 16	18	20.00	14 x 21	78	62.50
6 x 6	6	12.00	15 x 30	160	95.00
6 x 12	15	20.00	16 x 16	66	50.00
6 x 26	46	33.00	16 x 48	355	174.00
6 x 50	105	65.00	18 x 18	90	65.00
*6 x 72	280	108.00	18 x 24	120	88.00
6 1-2 x 18	30	26.50	18 x 36	180	115.00
7 x 7 1-2	10	15.00	20 x 30	200	126.00
7 x 10	15	20.00	24 x 24	205	119.00
8 x 12	19	23.00	24 x 36	285	182.00
9 x 9	16	18.50	24 x 48	485	245.00
9 x 14	29	24.50	24 x 60	696	317.00
10 x 15	39	30.00	30 x 36	375	228.00
10 x 30	86	63.50	30 x 60	800	394.00
10 x 50	190	105.00	36 x 68	1355	557.00
*11 x 84	800	240.00	....	....	....
12 x 12	30	28.50	....	....	....

\*Made to order only.

## Cast Iron Straight Edges



These Straight Edges are of a form best adapted to retain a straight line.

The edge of each is scraped to form a true surface, and the straight edges when thus made are indispensable in the proper scraping of the ways of planer and lathe beds, etc.

Size, Inches	Weight, Lbs.	Price, Including Cover
18 x 1 1-2	5	\$24.00
24 x 1 5-8	10	27.00
30 x 1 3-4	15	30.00
36 x 1 7-8	15	34.00
48 x 2	35	40.00
60 x 2 1-8	50	52.00
72 x 2 1-4	75	64.00
84 x 2 5-16	120	78.00
96 x 2 3-8	145	94.00
120 x 2 3-4	300	120.00
*144 x 3	420	....
*180 x 3 1-2	835	....

\*Made to order only. Prices upon application.

## Cast Iron Packing Boxes

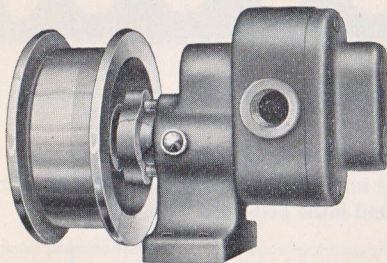
### For Use in Case Hardening and Annealing Furnaces

Prices upon Application.



## Nos. 1, 2 and 3 Geared Pumps

### FOR OIL OR WATER



These Pumps are principally used on machines where the cutting tools operate in only one direction, as Milling Machines, Gear Cutting Machines, Chucking Machines, etc., but, by running the pumps independently, they can be used on machines that reverse. They are simple in construction, the principal mechanism being a pair of gears which run together in a tight case and will force oil or water to 20 feet in height.

To obtain the best results the pumps should be placed as near as possible to the level of the liquid in the tank.

No.	Revolutions per Minute	Capacity, Qts. Per Min.	Suction, Inches	Discharge, Inches	Weight, Lbs.	Diam. of Driving Pulley, Inches	Size of Belt, Inches
1	{ 300 500	{ 4 8	{ 3-8	1-4 or 3-8	8	3 1-2	1
2	{ 300 500	{ 12 24	{ 1-2	3-8 or 1-2	14	4 1-4	1
3	{ 300 500	{ 20 40	{ 3-4	1-2 or 3-4	24	5	1 1-4

Price, No. 1.....\$11.00

Price, No. 2..... 13.50

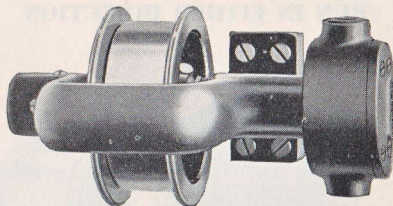
Price, No. 3..... 16.00

Without Pulley.....\$10.00

Without Pulley..... 12.25

Without Pulley..... 14.50

## No. 8 Oil Pump



Used in supplying oil to the cutting tools of metal-working machines, as screw machines, lathes, bolt cutters, etc. It changes automatically to pump when running in either direction. By placing the stops on the eccentric ring to the right or left of the pins in the case, either side of the pump may be used for the suction.

**Price, \$9.00. Without pulley, \$7.75**

Revolutions per Minute	Capacity, Qts. per Minute	Height Forced, Feet	Suction, Inches	Discharge, Inches	Weight, Lbs.
100	1	12	1-4	1-4	8 1-2
300	2	16	1-4	1-4	
500	4	20	1-4	1-4	

Driving Pulley, 3 1-2" diameter for 1" belt.

## Nos. 21 and 23 Bronze Circulating Pumps

These pumps differ from Nos. 1 and 3 only in being made entirely of bronze. The No. 23 has 25 per cent nickel steel shafts. Bronze shafts will be furnished if specified. Price on application.

**Price, No. 21.....\$20.00**

**Without Pulley.....\$19.00**

**Price, No. 23..... 42.00**

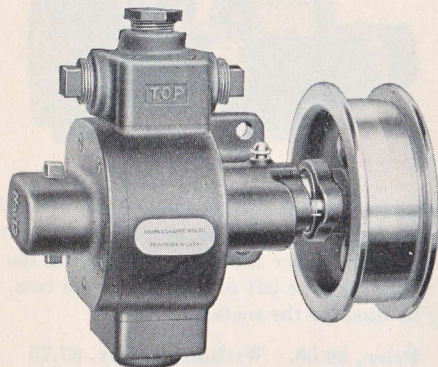
**Without Pulley..... 40.50**

**Weight, Complete, 7 lbs.**

# Nos. 11, 12 and 13 Geared Pumps

## FOR OIL OR WATER

### RUN IN EITHER DIRECTION



For use on machines, where the cutting tools operate in more than one direction, as on screw machines and machines that reverse. These pumps are simple in construction, the principal mechanism being a pair of gears which run together in a tight case and will force oil or water to 20 feet in height.

No.	Revolutions per Minute	Capacity, Qts. Per Min.	Suction, Inches	Discharge, Inches	Weight, Lbs.	Diam. of Driving Pulley, Inches	Size of Belt, Inches
11 {	300	4	} 3-8	1-4 or 3-8	10	3 1-2	1
	500	8					
12 {	300	12	} 1-2	3-8 or 1-2	15	4 1-4	1
	500	24					
13 {	300	20	} 3-4	1-2 or 3-4	30	5	1 1-4
	500	40					

Price, No. 11.....\$13.75

Without Pulley.....\$12.75

Price, No. 12..... 17.75

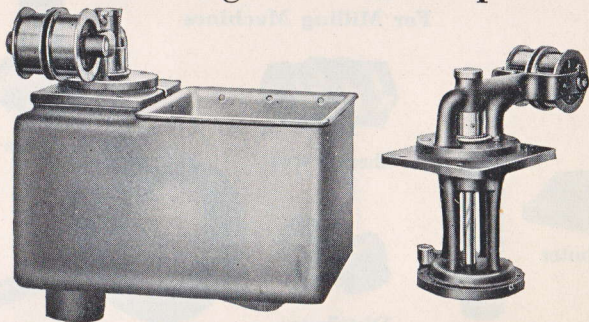
Without Pulley..... 16.50

Price, No. 13..... 24.00

Without Pulley..... 22.50



## Centrifugal Water Pumps



For use with water only. As the bearings do not come in contact with the water, they are well adapted for use on grinding machines or where the water contains emery or grit.

The pump consists of a simple fan which revolves in a horizontal plane and is immersed in the water. By this method the pump is constantly primed and there is no leak from loose packings.

The driving belt, which makes a quarter turn around the idle pulleys, furnished with the pump, can run over the counter-shaft or over pulleys connected with some part of the machine.

The bracket, which supports the idle pulleys, is held by two bolts that slide in slots, thus allowing the pulleys to be set in any desired position.

No.	Height Forced	4 feet	8 feet	12 feet	16 feet	20 feet	Discharge, Inches	Net Weight, Lbs.	Price
	Rev. per Minute	Capacity, Quarts per Minute							
2	800	7	..	..	..	..	3-8	40	\$25.00
	1000	13	6	..	..	..			
	1500	24	20	14	5	..			
4	500	8	..	..	..	..	3-4	85	55.00
	750	24	16	..	..	..			
	1200	96	53	40	28	16			

Minimum speed at which No. 2 Pump should run to raise water 4 feet, 800 rpm.; No. 4, 500 rpm.

Driving pulley, No. 2 Pump, 2" diameter for 1" belt; No. 4 Pump, 2 3-4" diameter for 1 1-4" belt.

## Tanks for Nos. 2 and 4 Pumps

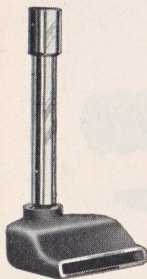
Provided with a settling pan and plug to draw off the water.

For No. 2. Weight, 67 lbs. Cap. 6 gals. Price, \$20.00.

For No. 4. Weight, 165 lbs. Cap. 21 gals. Price, 80.00.

## Pump Accessories

For Milling Machines



Distributer



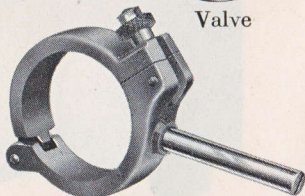
Relief Valve



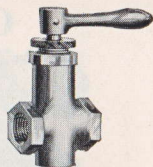
Check Valve



Distributer Swivel



Distributer Bracket



Valve

### Distributer

For Nos. 1 and 11 Pumps, Pipe Size 1-2"	\$3.50
For Nos. 2 and 12 Pumps, Pipe Size 3-4"	4.50
For Nos. 3 and 13 Pumps, Pipe Size 1"	5.50

### Distributer Bracket

For 2 3-4" Overhanging Arm	4.75
For 3 1-2" Overhanging Arm	6.00
For 4 1-4" Overhanging Arm	6.25
For 4 1-2" Overhanging Arm	6.50
For 4 3-4" Overhanging Arm	7.00
For 5" Overhanging Arm	7.50

### Distributer Swivel

For Use with 1-2" Distributer	2.75
For Use with 3-4" Distributer	3.25
For Use with 1" Distributer	4.50

### Valve

For Use with 1-2" Distributer, Pipe Size 1-2"	6.50
For Use with 3-4" Distributer, Pipe Size 3-4"	7.50
For Use with 1" Distributer, Pipe Size 1"	9.00

### Check Valve

3-8" for Nos. 1 and 11 Pumps	1.00
1-2" for Nos. 2 and 12 Pumps	1.10
3-4" for Nos. 3 and 13 Pumps	1.25

### Relief Valve

1-4" for Nos. 1, 8 and 11 Pumps	1.60
3-8" for Nos. 1 and 11 Pumps	2.20
1-2" for Nos. 2, 3, 12 and 13 Pumps	2.50

*Continued on next page.*

## Pump Accessories (Continued)

### For Milling Machines



Flexible Tube Swivel  
for Base and Table\*



Strainer

### Flexible Tube Swivel

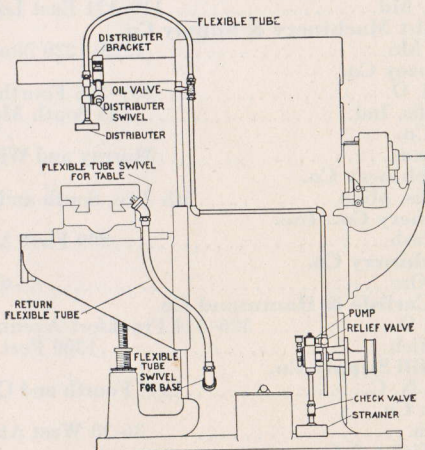
Used with Nos. 1 and 11 Geared Pumps, Pipe Size 3-4".....\$4.00  
Used with Nos. 2 and 12 Geared Pumps, Pipe Size 1"..... 6.00

\*45° for Universal Milling Machines; 90° for Plain Milling Machines.  
In ordering give style, size and serial number of machine, also state whether swivel is for base or table.

### Strainer

For No. 8 Oil Pump, Pipe Size 1-4".....\$1.25  
For Nos. 1 and 11 Geared Pumps, Pipe Size 3-8"..... 1.70  
For Nos. 2 and 12 Geared Pumps, Pipe Size 1-2"..... 2.00  
For Nos. 3 and 13 Geared Pumps, Pipe Size 3-4"..... 2.50

Other parts except flexible tubes are ordinary gas pipe and fittings.



Arrangement of Oil Piping for Milling Machines.



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\*Also Machinery Agents.

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